Arlington Conservation Commission

Date: Thursday, February 6, 2025
Time: 7:00 PM
Location: Conducted by Remote Participation.

Please register in advance for this meeting. Reference materials, instructions, and access information for this specific meeting will be available 48 hours prior to the meeting on the Commission's agenda and minutes page. This meeting will be conducted in a remote format consistent with Chapter 2 of the Acts of 2023, which further extends certain COVID-19 measures regarding remote participation in public meetings until March 31, 2025. Please note: Not all items listed may in fact be discussed and other items not listed may be brought up for discussion to the extent permitted by law. This agenda includes those matters which can be reasonably anticipated to be discussed at the meeting.

Agenda

1. Administrative
    a. Introducing Conservation Administrator Jackie Anderson.
    b. Review Meeting Minutes.
    c. Correspondence Received.
2. Discussion
    a. Certificate of Compliance Request: 1165R Massachusetts Avenue.
    b. Certificate of Compliance Request: 49 Spy Pond Lane.
    c. Enforcement Order: 40 Park Avenue.
    d. Enforcement Order Updates.
    e. Water Bodies Working Group.
    f. CPA Committee Liaison.
    g. Tree Committee Update.
3. Hearings

    DEP #091-0356: Notice of Intent: Thorndike Place (Continued from 01/16/2025).

    DEP #091-0356: Notice of Intent: Thorndike Place (Continued from 01/16/2025).
    The Conservation Commission will hold a public hearing under the Wetlands Protection Act to consider a Notice of Intent for the construction of Thorndike Place, a multifamily development on Dorothy Road in Arlington. Areas proposed to be altered include Buffer Zone to Bordering Vegetated Wetland and Bordering Land Subject to Flooding associated with Alewife Brook.

Town of Arlington, Massachusetts

Correspondence Received.

Summary:
Correspondence Received.

ATTACHMENTS:

	Type	File Name	Description
	Type	File Name	Description
🗋	Reference Material	Correspondence_Received_-_Thorndike_Place_-_Clarissa_Rowe.pdf	Correspondence Received - Thorndike Place - Clarissa Rowe.pdf
🗋	Reference Material	Correspondence_Received_-_Thorndike_Place_-_Scott_Horsley.pdf	Correspondence Received - Thorndike Place - Scott Horsley.pdf
🗋	Reference Material	Correspondence_Received_-_Thorndike_Place_-_Scott_Horsley_(ESHGW).pdf	Correspondence Received - Thorndike Place - Scott Horsley (ESHGW).pdf
🗋	Reference Material	Correspondence_Received_-_Thorndike_Place_-_MMA.pdf	Correspondence Received - Thorndike Place - MMA.pdf
🗋	Reference Material	Correspondence_Received_-_Thorndike_Place_-_MMA_-_Addendum.pdf	Correspondence Received - Thorndike Place - MMA - Addendum.pdf
🗋	Reference Material	Correspondence_Received_-_Thorndike_Place_-_Coalition_to_Save_the_Mugar_Wetlands.pdf	Correspondence Received - Thorndike Place - Coalition to Save the Mugar Wetlands.pdf

From:	Clarissa Rowe home
To:	David Morgan; Charles Tirone; Susan Chapnick; Jim Feeney
Subject:	Mugar Wetlands
Date:	Tuesday, February 4, 2025 9:18:23 AM

Hello All: After ten years, the Project Proponent still has not provided an acceptable drainage system and mounding analysis for their project. It puts their proposed project and the surrounding neighborhood at risk for future flooding.

It is assumed that the Conservation Commission will accept the project with conditions. However, I am writing to ask the Commission to reject the project outright. There is no place for this non compliant project in our Town.

Soon, the DEP will release new guidelines that would never allow a project like this one to go forward.

Clarissa Rowe, Landscape Architect

Please consider my request.
Sent from my iPhone

From:	Scott horsley
To:	David Morgan
Cc:	cmleich@comcast.net; Michael Mobile
Subject:	Re: Whitestone Report - Thorndike
Date:	Monday, February 3, 2025 12:39:39 PM

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or clicking links, especially from unknown senders.

Thanks David. Thanks for sending the BSC report with the attached soil logs.

I was able to contact Trevor Fletcher at Graz Engineering this morning. As it turns out Whitestone (the town's consultant) did not perform the test pits themselves. They subcontracted the work to Graz Engineering. Trevor told me that he performed the test pits with BSC and collaborated with them on the interpretation of estimated seasonal high groundwater (ESHGW). I am also noting that the notation of "some mottling" (which is an indicator of redox conditions) as noted by Trevor in the Whitestone report was not included in the BSC soil logs for that same test pit in their March 13, 2024 report. We were hoping for an independent, third-party analysis and interpretation.

I continue to be concerned about using 4.0 feet elevation as a reliable ESHGW on which to base engineering design. Furthermore, as you know, BSC is now suggesting that they do not need to perform a groundwater mounding analysis on the large infiltration system based upon this 4.0 elevation and purportedly having 4 feet vertical separation. We believe that there are some significant groundwater mounding issues that are not being evaluated at this location.

As I suggested a year ago in my comment letters and oral testimony before the Commission - the applicant should install monitoring wells and use a continuous recorder (pressure transducer) to document groundwater levels throughout the Spring months (March, April, and May). This could have easily been done last year. However, instead, BSC elected to make periodic, discrete water level measurements (instead of a continuous recorder) and missed the high groundwater levels during those months as evidenced by both the USGS Lexington well and our own wells installed on Dorothy Road (both of those wells used continuous recorders).

Yes, I am happy for you to pass all of this correspondence along to the Commission at your discretion. I believe the process should be totally transparent. Scott

Scott Horsley
Water Resources Consultant
https://www.linkedin.com/in/horsleyscott/
Cell: (508)-364-7818

On Mon, Feb 3, 2025 at 11:43 AM David Morgan <dmorgan@town.arlington.ma.us> wrote:

> Hi Scott,
>
> Thanks for your note. Would you like me to include it as correspondence for the Commission to review?

Soil logs were included for the test pits dug in 2023 (see Appendix C here [BSC Test Pit Summary Report - 03-13-2024]) but not for the latest round. We did not receive notice of the new pits being dug and could not request that they be witnessed. The activity was outside of the Commission's jurisdiction. I think it would be reasonable for the Commission to request them at Thursday's hearing and will suggest it to the chairs.

Cheers,

David

David Morgan | Environmental Planner + Conservation Agent | Department of Planning and Community Development | 781.316.3012

Arlington values equity, diversity, and inclusion. We are committed to building a community where everyone is heard, respected, and protected.

From: Scott horsley <scotthorsley208@gmail.com>
Sent: Sunday, February 2, 2025 4:41 PM
To: David Morgan <dmorgan@town.arlington.ma.us>
Cc: Chris Leich <cmleich@comcast.net>
Subject: Whitestone Report - Thorndike

David: I am preparing for the upcoming Con Comm meeting on Thorndike. We are concerned about the applicant's reliance on the Whitestone report and specifically using 4.0 feet as a reliable estimated seasonal high groundwater (ESHGW) elevation. As you may know, the applicant is relying on that elevation to avoid providing a groundwater mounding analysis on the largest infiltration system for the project - one that we believe is problematic.

I have noticed that the Whitestone report discounts redox observations in TP-7 as an indicator of ESHGW. The redox level suggests an elevation of 5.8 feet rather than 4.0 feet. I think that their reported redox level here fits reasonably with ESHGW elevations that I would expect on-site (5.0 - 6.0 feet).

Recently I noticed that in the Whitestone Report, the summary of the test pit logs indicated that the actual excavations and soil observations were not actually done by Whitestone, but instead by an apparent subcontractor. There is a note indicating that Trevor Fletcher did them. He works for Graz Engineering, not Whitestone (see attachment). I confirmed this with Whitestone representatives on the phone - they indicated that they had subcontracted the work.

Furthermore, we note that there are no soil logs attached to the Whitestone Report - just a summary table. This is unusual. It is standard practice to include the actual soil logs - this is the work done by Graz. Do you have them? If not, can we request them through Whitestone.

Given the importance of this ESHGW issue, it seems imperative that we have the actual data (soil logs) that Whitestone (and now BSC) is relying on to make this ESHGW determination.

Thanks in advance. Call me with questions. Scott

Scott Horsley

Water Resources Consultant

https://www.linkedin.com/in/horsleyscott/

Cell: (508)-364-7818

Scott Horsley
Water Resources Consultant
65 Little Road • Cotuit, MA 02635 • 508-364-7818

February 3, 2025

Mr. Charles Tirone, Chairperson
Town of Arlington
Conservation Commission
730 Massachusetts Avenue
Arlington, MA 02476

RE: Thorndike Place

Dear Mr. Tirone and Conservation Commissioners:

I have reviewed the recent reports prepared by BSC and peer reviewer GZA and offer the following comments. I continue to disagree with the suggested use of 4.0 feet as an appropriate seasonal high groundwater level. I have consistently questioned this value since the beginning of my reviews that I have provided to the town (2021). It is not based upon MADEP Handbook recommended methods and is inconsistent with other water level measurements in the area (including the wetland).

The applicant is now using this suggested value of 4.0 feet to avoid providing a groundwater mounding analysis of the stormwater infiltration system. They have adjusted the bottom of the infiltration system to elevation 8.0 and are claiming because they have 4-feet vertical separation that they are no longer obligated to provide a groundwater mounding analysis of that system.

We respectfully ask the Arlington Conservation Commission and GZA to reconsider the determination of estimated seasonal high groundwater (ESHGW) elevation of 4.0 which is used as the foundation for the site design. There are multiple lines of evidence that suggest that this value of 4.0 is not reliable and likely understates the required design elevation. Specifically, we request a fresh look at test pit data provided by the town's consultant Whitestone, the applicability of the water level data provided at the USGS Lexington well and our own wells installed along Dorothy Road on behalf of the Arlington Land Trust (ALT). These multiple lines of evidence are as follows.

1. The MADEP Handbook: The MADEP Handbook provides two accepted methods to determine estimated seasonal high groundwater (ESHGW). These include 1) the identification of redoximorphic (redox) features (exhibited as water stains in the soils), and 2) measured water levels during the Spring months that are then compared (and adjusted if necessary) with USGS index wells (see Figure 1 below). These methods were <u>not</u> followed by the applicant in identifying the ESHGW elevation. They did <u>not</u> use the redox features which were identified by Whitestone and they did <u>not</u> compare (and adjust) their groundwater level measurements with USGS wells.

> *Determining Seasonal High Groundwater*
>
> Seasonal high groundwater represents the highest groundwater elevation. Depth to seasonal high groundwater may be identified based on redox features in the soil (see Fletcher and Venneman listed in References). When redox features are not available, installation of temporary push point wells or piezometers should be considered. Ideally, such wells should be monitored in the spring when groundwater is highest and results compared to nearby groundwater wells monitored by the USGS to estimate whether regional groundwater is below normal, normal or above normal (see: http://ma.water.usgs.gov).

Figure 1 – Excerpt from MADEP Stormwater Handbook, Volume 3, Chapter 1

2. The Whitestone Report: Two test pits were conducted May 18, 2023 by the town's contractor Whitestone within the proposed infiltration system INF-1. TP-7 in this report identified redox features at a depth of 32 inches (elevation 5.8). However, this was discounted as "likely perched". Yet, no confining layers that might create a perched condition are noted in any of the four test pits within the proposed area of infiltration system 1P. This observation of redox features complies the methods recommended in the MADEP Stormwater Handbook to determine seasonal high groundwater and deserves further consideration as a reasonable indication of ESHGW.

3. Measured Water Levels: BSC conducted two additional test pits within the area of the infiltration system INF-1 on April 17, 2024. Neither of these test pits exhibited redox features. Therefore, BSC observed the depth of "weeping water" in the test pit TP-9 at 90 inches (7.5 feet) and simply subtracted this from the test pit grade elevation (11.47 feet) and calculated a value of 3.97 feet (see Table 1 below). Based upon this they assumed the ESHGW elevation of 4.0.

"Weeping water" refers to temporarily observed water seeping (or weeping) from the sidewalls of the test pit at the time of the excavation. This is not an acceptable method to identify ESHGW. Rather, this simply shows a minimum level observed at the time of the test pit excavation.

Table 1 – Water Level Measurements and ESHGW estimates (BSC, April 17, 2024)

Test Pit	Existing Grade	Total Depth (in.)	Depth Fill (in.)	Depth Standing GW (in.)	Depth Weeping GW (in)	Depth to Redox (in.)	ESHGW
TP-7	8.92	114	108	110	n/a	n/a	-0.24
TP-8	11.83	120	120	n/a	112	n/a	2.50
TP-9	11.47	118	100	116	90	n/a	3.97
TP-10	11.27	130	130	126	94	n/a	3.44
TP-11	11.09	114	114	111	93	n/a	3.34
TP-12	8.37	76	76	68	53	n/a	3.95
TP-13	7.96	74	74	67	57	n/a	3.21

4. Comparison with USGS Wells: As stated earlier (and shown above in Figure 1), the MADEP Handbook recommends comparing observed groundwater levels with USGS wells. However, no such comparison (or adjustment) was made by BSC with USGS index wells.

Figure 2 shows a comparison of water levels measured in a well installed by BSC at the location of TP-9 (red dots) with the USGS Lexington well hydrograph during the 2024 spring period. This comparison shows that BSC water level measurements were reported on dates that missed all of the peak levels recorded at the USGS well during the Spring 2024 period. The highest groundwater levels were observed at the USGS well on March 24, 29, and April 4. Had BSC used a continuous recorder (as I recommended in my earlier comment letters) they would have likely recorded higher levels, consistent with the USGS well).

This comparison shows that the highest water level measured by BSC was on April 1 when the USGS well was more than one foot below its peak high measurement on March 10. This suggests that the ESHGW would be at least 5.0 feet. This would be consistent with the redox level of 5.8 feet reported by Whitestone.

This same variance in groundwater levels is further corroborated with our own water level measurements at the Arlington Land Trust well located on Dorothy Road which showed a peak elevation on March 29, 2024 and a similar decline throughout much of April to a level of approximately 1-foot lower on April 17 when the test pits were excavated (see figure 3). This suggests that the relative groundwater level fluctuations over this period are consistent with the USGS Lexington well (which showed a 1-foot decline during this same period).

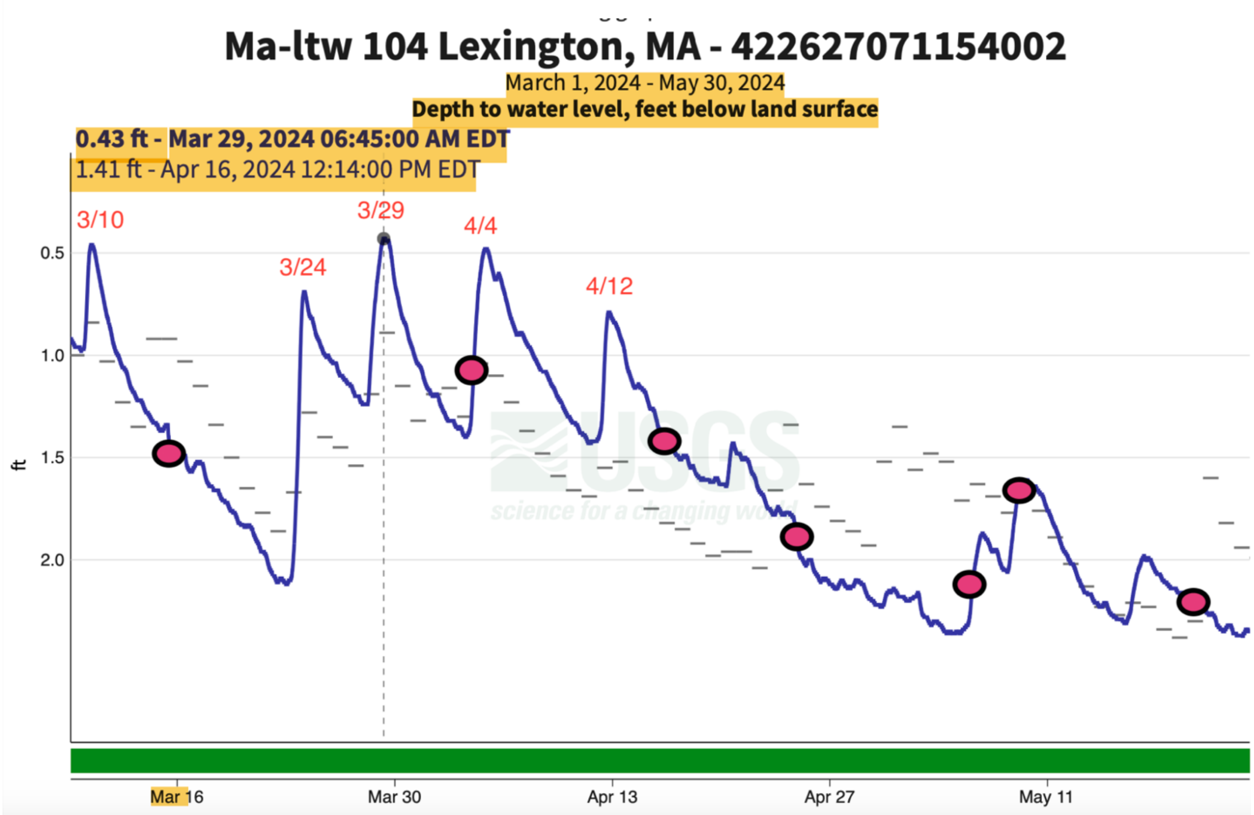

Figure 2 - Hydrograph for USGS Lexington Index Well (March - April 2024)

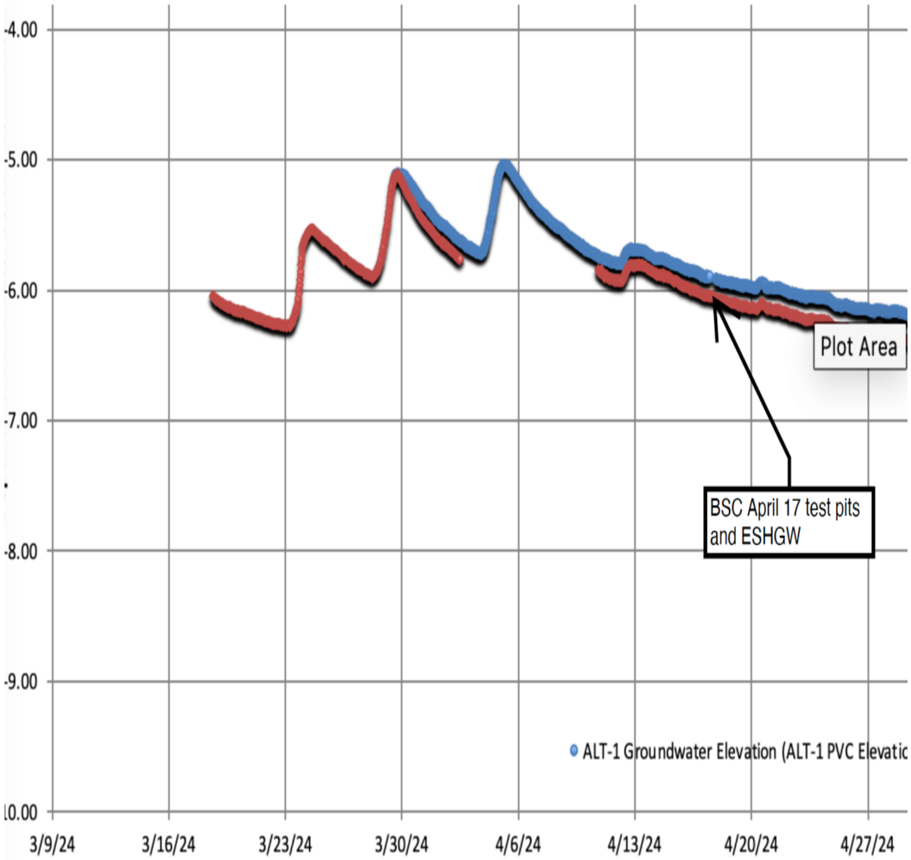

Figure 3 - Hydrograph for Arlington Land Trust (ALT) Monitoring Wells at Dorothy Road (March - April 2024)

5. Summary

In summary, I believe that:

a) the applicant underestimates seasonal high groundwater conditions and a value of 5.0 – 5.8 feet should be utilized rather than 4.0 feet. This provides a more realistic and conservative value.

b) a groundwater mounding analysis is required and should be evaluated for the revise infiltration system #1. This has not been provided by the applicant.

Thank you for the opportunity to provide these comments. Please contact me directly with any questions that you might have.

Sincerely,

Scott W. Horsley
Water Resources Consultant

February 3, 2025

Town of Arlington Conservation Commission
Attn: Mr. Charles Tirone, Chairperson
730 Massachusetts Avenue
Arlington, MA 02476

RE: **Thorndike Place, Dorothy Road, Arlington, Massachusetts – Preliminary Comments on GZA Peer Review**

Dear Mr. Tirone and Commission Members,

McDonald Morrissey Associates, LLC (MMA) is providing this letter to relay comments that respond to certain elements of the January 28, 2025 technical review letter pertaining to the subject line project that was issued to the Commission by GZA GeoEnvironmental, Inc. (GZA)[1]. These comments are as follows:

- Consistent with MMA's January 15, 2025 letter, GZA acknowledges that simultaneous infiltration from other nearby systems (e.g., System 1) would result in groundwater mounding that could interfere—and be additive on top of—mounding generated by System 7. After correcting erroneous inputs used by BSC, GZA performs their own mounding calculation for System 7 using the Hantush analytical model (i.e., BSC's selected mounding analysis method). GZA's results show a groundwater mound rising to within approximately 0.5 feet of the bottom of System 7, but this result ignores the additive influence of System 1. As demonstrated in MMA's January 15, 2025 letter, if the additive System 1 influence is considered using a comparable modeling method to BSC's, there is clear evidence of groundwater mounding rising well above the bottom of System 7. Thus, at a minimum, additional analysis is necessary to support GZA's claim that groundwater mounding will not adversely impact the drainage time of System 7, nor the rate control capability of the overall stormwater system, to the point of violating MSH requirements.

- MMA generally agrees with GZA's view on the need for consistency between initial infiltration rate and duration inputs to mounding analyses and HydroCAD assumptions and output for the 100-year, 24-hour design storm event. However, MMA notes that GZA does not acknowledge—nor seek correction of—unjustified/unsupported infiltration rates used by BSC in their HydroCAD model. As stated in MMA's January 15, 2025 letter, BSC inexplicably uses an infiltration rate of 0.52 inches per hour (in/hr) for certain proposed features, including System 1;

[1] Letter to Mr. David Morgan, Town of Arlington, from Anthony B. Urbano, GZA GeoEnvironmental, Inc. *RE: Response to January 2025 Redesign, Peer Review of Stormwater Mound Evaluation, Proposed Thorndike Place Residential Development, Arlington, Massachusetts*. Dated January 28, 2025.

whereas, BSC has only claimed to justify the use of an infiltration rate of 0.27 in/hr. This issue must be corrected and HydroCAD simulations must be reperformed to generate representative results that can be used as inputs to subsequent mounding analyses.

- MMA acknowledges GZA's recommendations regarding peat removal and underdrain design. However, MMA notes neither action has been accounted for in any mounding analysis performed to date, including the calculations presented in GZA's letter. The ultimate influence of certain modifications would depend on specific design characteristics and site conditions (e.g., drain position, capacity, lateral extent of peat deposits, etc.). It would therefore be premature and speculative to rely on any mitigating function associated with these modifications, though MMA notes we are not suggesting any such claim is being made by GZA or BSC.

- MMA reiterates our disagreement with GZA's opinion on the "suitability" of BSC's claimed estimated seasonal high groundwater (ESHGW) condition of elevation 4.0-feet[2]. In our opinion, if established in accordance with Massachusetts Stormwater Handbook (MSH) requirements, the resultant ESHGW condition would reside above this elevation, and a mounding analysis for System 1 would continue to be required under the revised design. Furthermore, based on information presented to date, and under the assumption that BSC would apply the same analytical technique(s) used to date, MMA sees no evidence that such an analysis would be successful in demonstrating compliance with certain applicable MSH requirements.

The comments presented herein are preliminary and based on information made available to MMA as of the indicated transmittal date. MMA therefore reserves the right to amend and/or extend this commentary based on expanded review and/or review of new information provided by the Applicant or other interested parties.

Sincerely,

Michael Mobile, Ph.D., CGWP
President, McDonald Morrissey Associates, LLC

MAM/
Z:\1_Projects\Arlington\Thorndike_Place\7_Reports_and_Memos\Comment_on_GZA_2-3-25\FINAL_MMA_Review_Letter_2-3-25.docx

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[2] Refer to Letter to Mr. David Morgan, Town of Arlington, from Anthony B. Urbano, GZA GeoEnvironmental, Inc. *RE: Peer Review of Stormwater Mound Evaluation and Design Groundwater Elevation, Proposed Thorndike Place Residential Development, Arlington, Massachusetts*. Dated August 1, 2024.

Additive Mounding Impacts – Numerical Example

- Not to be used by others to support any current or future proposed design. Reliable site-specific modeling would require additional effort (e.g., calibration) and supporting information/data.

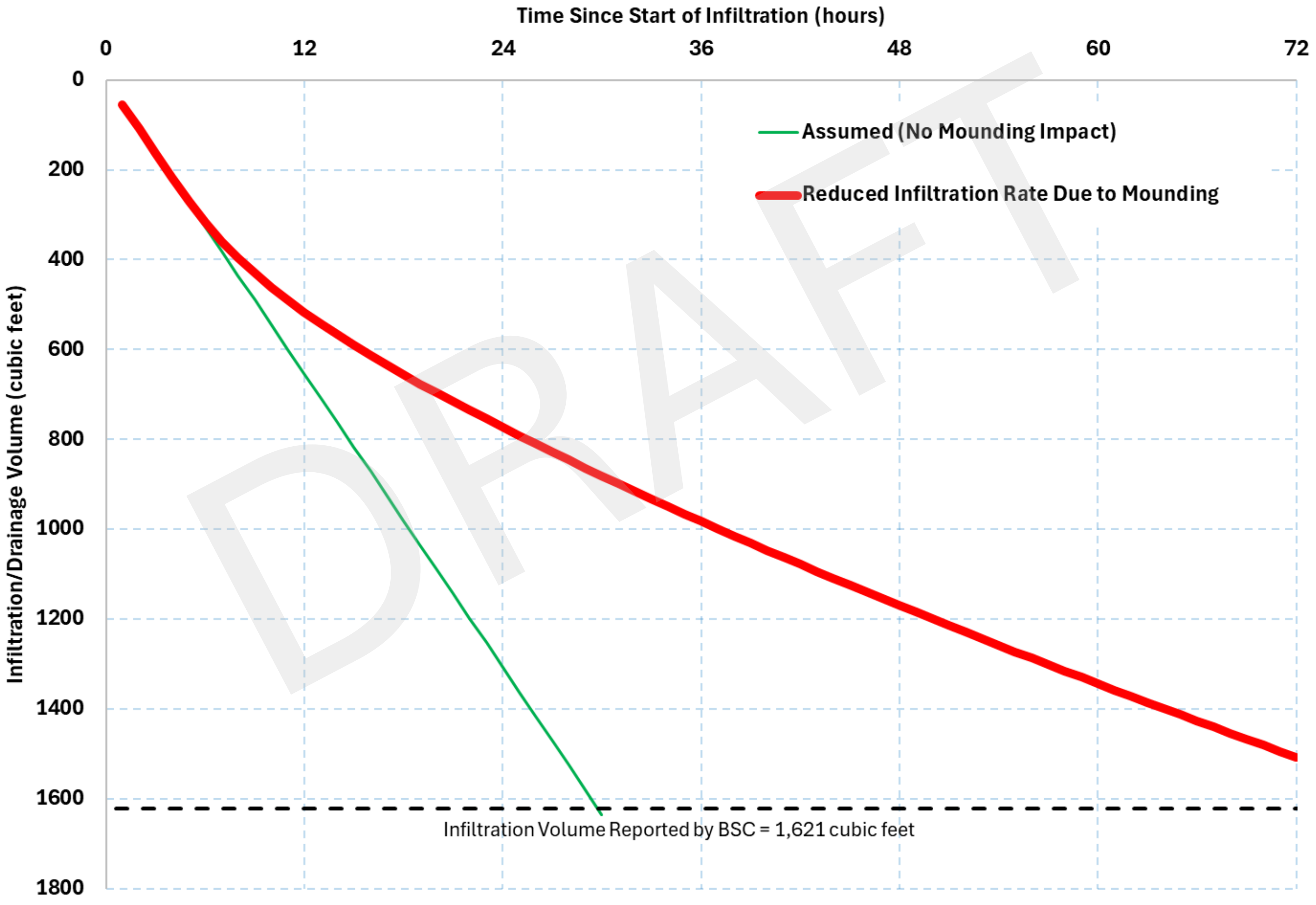
- **Intent: if the mounding analysis were to account for effects from other systems and subsurface barriers, what would it generally show?**

- Relies on nearly identical set of assumptions BSC accepted in using Hantush (e.g., quasi-infinite aquifer extent, aquifer properties, etc.)

- Allows for representation of all simultaneously active infiltration systems (rain garden excluded), local lateral boundaries (foundations) w/ accurate vertical extent, etc.

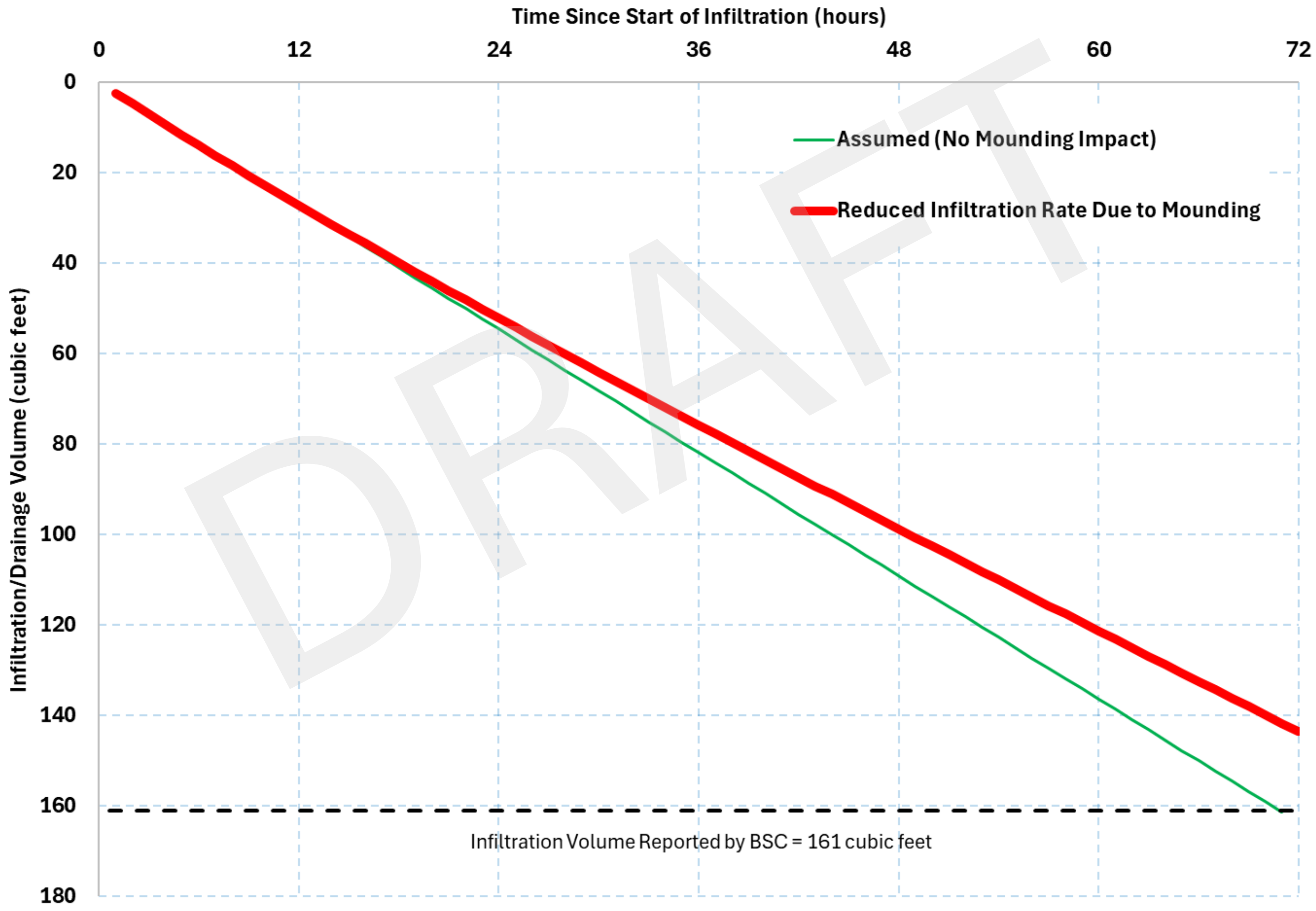
- Can approximate adverse effects of mounding on infiltration rates using head-dependent boundary conditions rather than specified flows at infiltration systems.

Numerical Example – System 7

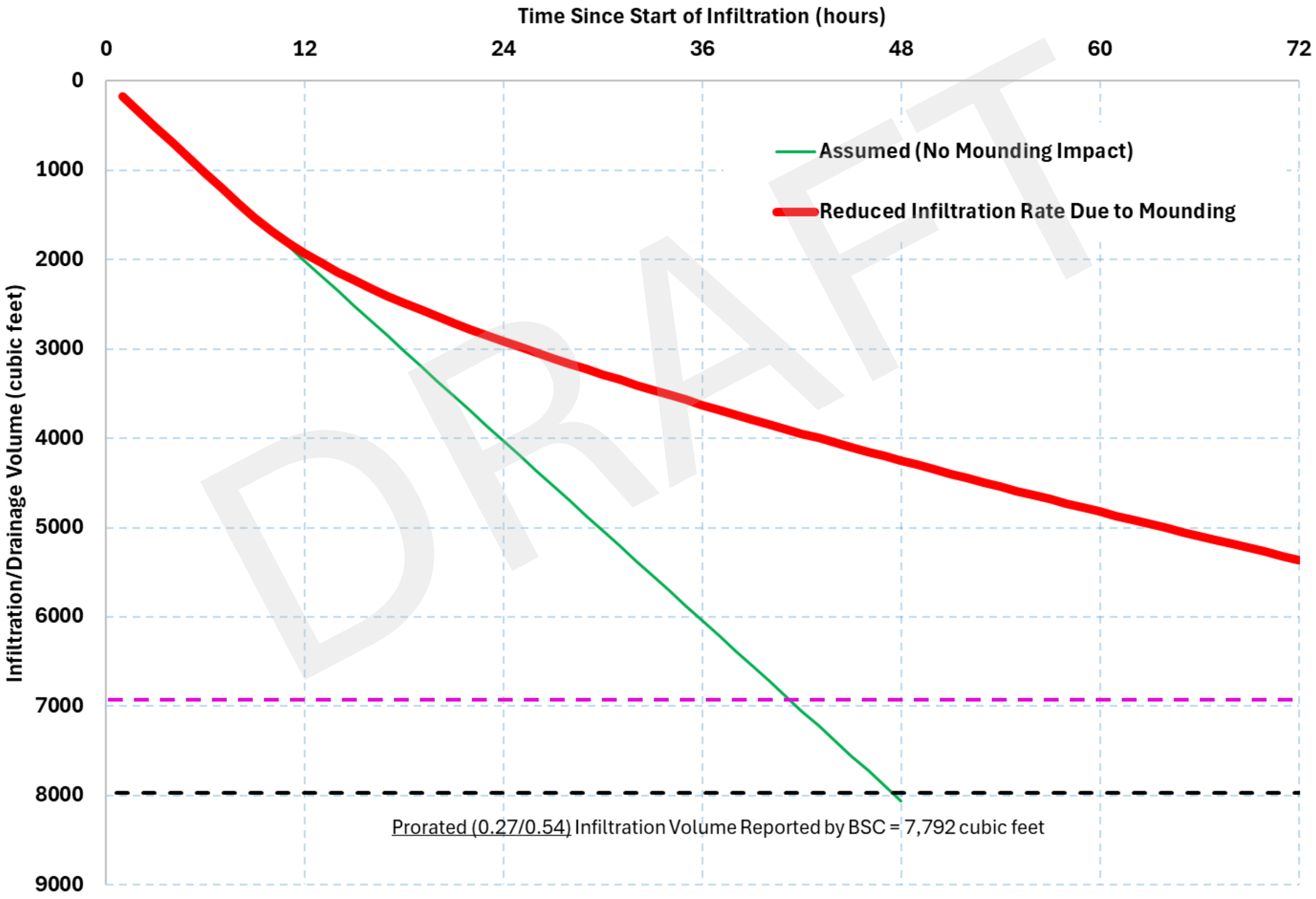


McDonald Morrissey ASSOCIATES, LLC
GROUND WATER HYDROLOGISTS

Numerical Example – System 2 (Townhomes)



Numerical Example – System 1



2-Year, 24-Hour Storm
Prorated (0.27/0.54) Infiltration Volume Reported by BSC = 6,946 cubic feet

McDonald Morrissey Associates, LLC
Ground Water Hydrologists

From:	Michael Mobile
To:	David Morgan; ConComm; Chuck Tirone; Susan Chapnick
Cc:	Chris Leich; Scott horsley
Subject:	RE: Thorndike Place - Comment Letters on GZA Review
Date:	Wednesday, February 5, 2025 12:39:53 PM
Attachments:	image001.png image002.png MMA_Numerical_Example_Slides_2-6-25.pdf

Good Afternoon David and Commission Members,

I have attached a supplement to my latest comment letter, dated February 3, 2025. The slides, which I hope to present during tomorrow night's meeting, summarize a numerical modeling (i.e., MODFLOW) example that further supports the points raised in my latest letter and prior letters.

Consistent with industry-standard practice, I am sharing the electronic model files to facilitate reviews of the inputs and results. A directory containing a ZIP archive and a README, which must be reviewed prior to extracting files from the archive, is accessible via the following link: https://tinyurl.com/wnmjhuc5

Please acknowledge this email and the attached materials have been received.

Much appreciated,

Mike

Michael Mobile, Ph.D., CGWP
McDonald Morrissey Associates, LLC
46 S. Main Street, Suite 3, Concord, NH 03301 (**NEW ADDRESS**)
MikeMobile@McDonaldMorrissey.com
Office: 603-228-2280
Mobile: 603-493-5560

McDonald Morrissey ASSOCIATES, LLC
GROUND WATER HYDROLOGISTS

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this transmission, including any attachments, without reading or saving in any manner. Thank you.

From: Michael Mobile
Sent: Monday, February 3, 2025 4:10 PM
To: David Morgan <dmorgan@town.arlington.ma.us>; ConComm <ConComm@town.arlington.ma.us>; Chuck Tirone <ctirone@ci.reading.ma.us>; s.chapnick@comcast.net
Cc: Chris Leich <cmleich@comcast.net>; Scott horsley <scotthorsley208@gmail.com>
Subject: Thorndike Place - Comment Letters on GZA Review

Good Afternoon David and Commission Members,

I have attached two comment letters that pertain to the proposed Thorndike Place project. Please acknowledge they have been received.

Thank you,

Mike

Michael Mobile, Ph.D., CGWP
McDonald Morrissey Associates, LLC
46 S. Main Street, Suite 3, Concord, NH 03301 (**NEW ADDRESS**)
MikeMobile@McDonaldMorrissey.com
Office: 603-228-2280
Mobile: 603-493-5560

McDonald Morrissey ASSOCIATES, LLC
GROUND WATER HYDROLOGISTS

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Coalition to Save the Mugar Wetlands

February 3, 2025

To Members of the Conservation Commission:

After the October 24th hearing, GZA was expected to address questions and concerns raised by Scott Horsley and Mike Mobile. To our knowledge, no response was provided. Instead, the hearing process has been delayed over two months while BSC completely redesigns their stormwater mitigation plan, which was previously presented as FINAL.

As noted in our letter dated November 17th (see attached), BSC's seasonal high groundwater data is under-estimated. This data is being used in their redesign to avoid a groundwater mounding analysis of the stormwater infiltration system.

The core issue remains that GZA is working with inaccurate information. We strongly urge the Conservation Commission to give serious consideration to the data from the Town wells, as it directly contradicts the Applicant's findings. Relying on the Applicant's flawed data could result in a development that poses a significant risk to the health and safety of our neighborhood and community.

Thank you on Behalf of the Coalition to Save the Mugar Wetlands,

Jeanette Cummings, 32 Dorothy Rd.
Julie DiBiase, 29 Littlejohn St.

Cc: James Feeney, Arlington Town Manager
David Morgan, Environmental Planner/Conservation Agent
Arlington Select Board
Arlington Land Trust

November 17, 2024

To Members of the Conservation Commission:

It is our understanding that the hearing scheduled for November 7th was continued due to outstanding comments from the peer reviewer, and BSC once again needing to amend their plans. While we acknowledge GZA needing to respond to questions raised by Scott Horsley and Mike Mobile at the October 24th hearing, BSC delivered their revised stormwater mitigation plan as their FINAL plan. BSC represented their numbers as reliable, their design as functional and in compliance. At that time, it was clear that Attorney Keifer anticipated to close the hearings that evening.

One would expect BSC to stand by their design and not have to revise it further! However, the continued questioning of the validity of BSC's data by ALT's experts raises significant concerns. As issues arise, there's never any certainty on BSC's part. It appears that BSC is repeatedly adjusting their data and numbers in an attempt to make this project work, rather than presenting a consistent and reliable analysis.

In particular, BSC's groundwater data is problematic and, in our view, erroneous. This is evident when compared with data from the Town's digitally monitored wells installed March 18, 2024. Even after missing several significant rainstorms, the Town's wells recorded water levels exceeding a 4-foot depth, while BSC has repeatedly asserted that the high-water table limit is 4 feet. This discrepancy calls into question the accuracy of the data BSC has used in its design and analysis.

The specific issues identified include:

- **BSC's Wells Installation Timing:** BSC's wells were installed ***after*** the peak of seasonal high groundwater, meaning they may not have captured the highest groundwater levels of the season.

- **Lack of Continuous Monitoring**: Unlike the Town's wells, which were continuously monitored, BSC's wells only recorded readings at specific points in time, failing to capture fluctuations that could be critical to understanding seasonal changes in groundwater levels.

- **Underestimation of Seasonal High Groundwater Levels**: The data from BSC's wells appears to have underestimated the seasonal high groundwater levels, which are essential for designing effective stormwater mitigation and ensuring the project's long-term viability.

- **Contradictory Data from Town Wells**: The Town's wells have shown that groundwater levels were on the decline at the time of BSC's well installation, which further questions the validity of BSC's conclusions.

Given these points, our position remains that the data provided by BSC is inaccurate and misleading. As a result, the proposed Thorndike Place development, based on this faulty data, poses a significant risk to the well-being of our neighborhood and our community. If there is any uncertainty or lack of confidence in the data and design, it is impossible to justify approval of this project*, with or without* conditions. Therefore, we respectfully urge the board to deny this project.

Thank you on Behalf of the Coalition to Save the Mugar Wetlands

Cc: James Feeney, Arlington Town Manager
David Morgan, Environmental Planner/Conservation Agent
Arlington Select Board
Arlington Land Trust

Town of Arlington, Massachusetts

Certificate of Compliance Request: 1165R Massachusetts Avenue.

Summary:
Certificate of Compliance Request: 1165R Massachusetts Avenue.

ATTACHMENTS:

	Type	File Name	Description
🗋	Reference Material	Access_and_Conservation_Easement_re_Land_Under_Water_and_Stream_Bank_(recorded)__-_Ryder_Brook.pdf	Access and Conservation Easement re Land Under Water and Stream Bank (recorded) - Ryder Brook.pdf

Middlesex South Registry of Deeds

Electronically Recorded Document

This is the first page of the document - Do not remove

Recording Information

Document Number	: 11048
Document Type	: EASE
Recorded Date	: January 31, 2025
Recorded Time	: 11:31:16 AM
Recorded Book and Page	: 83732 / 410
Number of Pages(including cover sheet)	: 11
Receipt Number	: 3061787
Recording Fee	: $105.00

Middlesex South Registry of Deeds
Maria C. Curtatone, Register
208 Cambridge Street
Cambridge, MA 02141
617-679-6300
www.middlesexsouthregistry.com

Recording requested by and when recorded return to:

Robinson & Cole LLP
One Boston Place
Boston, MA 02108
Attention: Matthew J. Lawlor, Esq.

ACCESS AND CONSERVATION EASEMENT REGARDING LAND UNDER WATER AND STREAM BANK

[Property Address: 1165R Massachusetts Avenue, Arlington, MA.]
Deed in Book 79780, Page 564

THIS **ACCESS AND CONSERVATION EASEMENT REGARDING LAND UNDER WATER AND STREAM BANK** (this "**Easement**"), is made this 30th day of January, 2025, by **1165R MASS MA PROPERTY LLC**, a Delaware limited liability company with an address of c/o Spaulding & Slye Investments, 71 Commercial Street, #266, Boston, Massachusetts 02109 (the "**Grantor**"), in favor of the **TOWN OF ARLINGTON CONSERVATION COMMISSION**, a Massachusetts municipality with an address of 112 Mystic Street, Arlington, Massachusetts 02474 (the "**Grantee**").

Grantor hereby grants to Grantee the perpetual right and easement to access, maintain, inspect, repair, replace, and protect the land under water of the relocated Ryder Brook (respectively, the "**Stream Easement**" and the "**Stream Easement Area**") and further Grantor hereby grants to Grantee the perpetual right and easement to access, maintain, inspect, repair, replace, and protect the stream bank of the relocated Ryder Brook (respectively, the "**Bank Easement,**" and collectively with the Stream Easement, the "Stream and Bank Easement," and the "**Bank Easement Area,**" and collectively with the Stream Easement Area, the "**Stream and Bank Easement Area**") located on that certain property of Grantor located at 1165R Massachusetts Avenue in Arlington, MA, more specifically described and shown on the plan entitled "Deed Restriction Area Exhibit Plan for 1165R Mass MA Property," dated May 16, 2022, prepared by Bohler Engineering, and attached hereto at Exhibit A and hereby made a part hereof (the "**Stream and Bank Easement Plan**"), as required to protect stormwater and flood control systems by that certain "Decision on Application for Comprehensive Permit, G.L. c.40B, §§20-23," issued by the Arlington Zoning Board of Appeals, filed with the Arlington Town Clerk on September 17, 2021,

and recorded with the Middlesex South Registry of Deeds (the "**Registry**") in Book 79029, Page 164, and that certain Order of Conditions issued by the Arlington Conservation Commission on October 28, 2021, and recorded with the Registry in Book 79496, Page 78 (together, the "**Project Approvals**"). As shown on the Stream and Bank Easement Plan, the Stream and Bank Easement Area is labeled with cross-hatching and defined as "Prop. Deed Restriction Area for Bank and Land Under Water for Relocated Ryder Brook." A metes and bounds description of the Stream Easement Area is attached hereto as Exhibit B and a metes and bounds description of the Bank Easement Area is attached hereto as Exhibit C.

1. Purpose

The purpose of this Easement is to provide Grantee with access to the Stream and Bank Easement Area in order to maintain and protect the critical stormwater handling and storage capacity thereof. Any and all jurisdictional activities outside of the scope of maintenance performed in the Stream and Bank Easement Area shall require the approval of Grantor and consultation with, and, where required by applicable law, permitting by, the Town of Arlington Conservation Commission. Accordingly, Grantee shall have the right to conduct the following activities in the Stream and Bank Easement Area:

a. Access the Stream and Bank Easement Area as shown on the Stream and Bank Easement Plan, labeled with hatching and defined as "Prop. Access Area to Relocated Ryder Brook," with vehicular access and parking only areas related thereto as shown on the Stream and Bank Easement Plan;
b. Post stream and bank protection signs;
c. Conduct routine inspections; and
d. Place stream and bank protection measures, including but not limited to stabilizing structures, fences, measures deemed by Grantee, in its reasonable judgment, to be necessary or beneficial for the operation, maintenance and protection of the Steam and Bank Easement Area.

2. Conditions

a. Prohibited Uses

Grantor and Grantee agree that, with the exception of the Reserved Rights set forth in Subsection (b), below, uses or activities inconsistent with the preservation of the land under water and stream bank located within the Stream and Bank Easement Area may not occur or be made therein. Without limitation, Grantee and Grantor agree that the following uses and activities are not allowed in the Stream and Bank Easement Area:

1. Motorized vehicles of any kind;
2. Disposal or discharges of hazardous materials or wastes;
3. Storage of hazardous materials;
4. Storage or use of fertilizers or pesticides;
5. Access by the general public; and

6. Installation or construction of structures not related to the operation, maintenance, or protection of land under water and stream bank.

b. Reserved Rights

Grantor agrees that neither they, nor their successors or assigns, will impair or interfere with the purpose of this Easement for stormwater and flood control, maintenance, and protection. Notwithstanding the provisions of Subsection (a), above, the following rights are reserved by Grantor:

1. Installation, maintenance, repair, replacement, and/or removal of existing stormwater infrastructure in the Stream and Bank Easement Area;
2. Selective cutting or pruning of trees, brush, and other vegetation to prevent, control or remove hazards, disease, insect damage, fire damage, storm damage or invasive species; and
3. Other activities, uses, and structures not inconsistent with the Stream and Bank Easement's purposes of protecting stormwater and flood control facilities within the Stream and Bank Easement Area.

3. Access and Enforcement

Grantee is granted an easement to permit personnel of Grantee to enter the Stream and Bank Easement Area with reasonable advance written notice to Grantor, for the purpose of inspecting the same to determine compliance with or to enforce the conditions of this Easement or take any and all actions as may be necessary or appropriate with or without order of court, to remedy or abate any material violation hereof, provided that Grantee has provided prior written notice to Grantor of such material violation and given Grantor a reasonable amount of time from the date of receipt of notice in which to cure such material violation. The provisions of this Easement, which is executed under seal, shall be in effect in perpetuity, and shall be binding upon and may be enforced against Grantor and Grantee and its successors and/or assigns.

4. Amendment

Modifications and amendments may be made by a written instrument executed by Grantor and Grantee, or their respective successors and/or assigns.

5. Duration; Release

Grantor intends this Easement to be in effect in perpetuity. This Easement may only be released, in whole or in part, by Grantee in writing.

6. Notice

Any notice or communication hereunder shall be effective only if given in writing and shall be deemed duly delivered if (i) hand delivered; (ii) mailed by prepaid certified or registered mail, return receipt requested; or (iii) delivered by a national overnight delivery service, delivery

confirmed. Any notice so addressed shall be deemed duly delivered on the third business day following the day of mailing if so mailed by registered or certified mail, return receipt requested, whether or not accepted, or on the date of delivery if hand delivered or sent by overnight delivery service, to the following addresses:

To Grantor:

1165R MASS MA PROPERTY LLC
c/o Spaulding & Slye Investments
71 Commercial Street, #266
Boston, Massachusetts 02109
Attention: Portfolio Manager

and

1165R MASS MA PROPERTY LLC
c/o Spaulding & Slye Investments
1410 19th Street, NW, Suite 610
Washington, DC 20036
Attention: General Counsel

To Grantee:

TOWN OF ARLINGTON
51 Grove Street
Arlington, Massachusetts 02476
Attention: Zoning Board of Appeals

and

TOWN OF ARLINGTON
730 Massachusetts Avenue Annex
Arlington, Massachusetts 02476
Attention: Conservation Commission

Either party may from time to time designate other addresses within the continental United States by notice to the other.

7. Governing Law

This Easement shall be deemed to constitute a contract made under seal and governed by the laws of the Commonwealth of Massachusetts.

[This page ends here. Signature appears on following page.]

IN WITNESS WHEREOF, Grantor has caused this Easement to be executed as of the Effective Date.

GRANTOR:

1165R MASS MA PROPERTY LLC,
a Delaware limited liability company

By: ______________________
Name: Arthur C. Frye
Title: Authorized Signatory

DISTRICT OF COLUMBIA
~~**Commonwealth of Massachusetts**~~
County of WASHINGTON, DC

On this 24th day of JANUARY, 2024, before me, the undersigned notary public, personally appeared ARTHUR FRYE, as Authorized Signatory of 1165R MASS MA PROPERTY LLC, proved to me through satisfactory evidence of identification, which was DRIVER'S LICENSE, to be the person whose name is signed on the preceding document, and acknowledged to me that he/she/they signed it voluntarily for its stated purpose on behalf of said entity and as the voluntary act of said entity.

____
Notary Public
Print Name of Notary: DESTINE FREEMAN
My commission expires: 09/30/2027

DESTINE FREEMAN
NOTARY PUBLIC
DISTRICT OF COLUMBIA
EXP. 09/30/2027

EXHIBIT A

Stream and Bank Easement Plan

[See attached.]

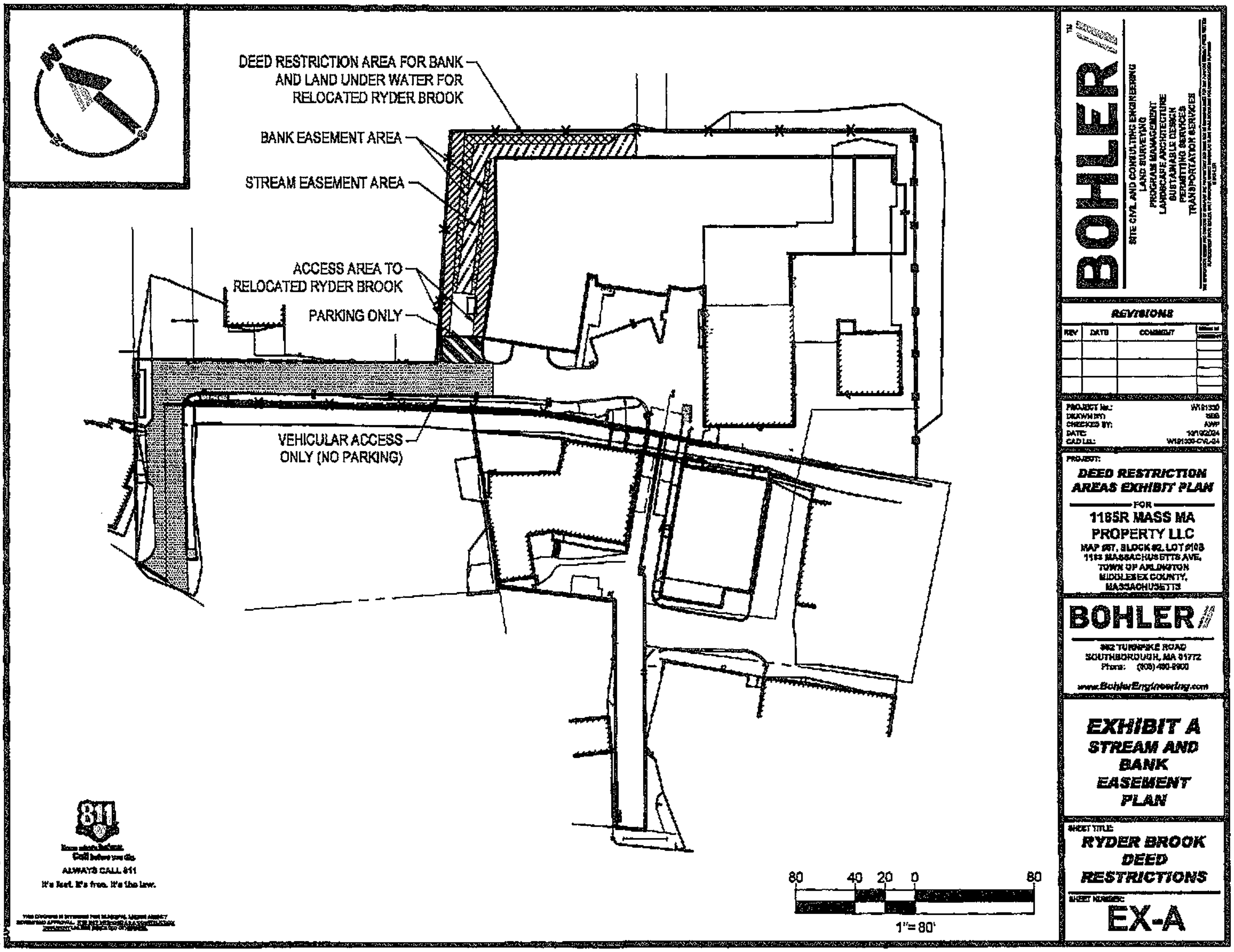

DEED RESTRICTION AREA FOR BANK
AND LAND UNDER WATER FOR
RELOCATED RYDER BROOK
BANK EASEMENT AREA
STREAM EASEMENT AREA
ACCESS AREA TO
RELOCATED RYDER BROOK
PARKING ONLY
VEHICULAR ACCESS
ONLY (NO PARKING)
BOHLER
SITE CIVIL AND CONSULTING ENGINEERING
REVISIONS
REV
DATE
COMMENT
PROJECT:
DEED RESTRICTION
AREAS EXHIBIT PLAN
FOR
1165R MASS MA
PROPERTY LLC
TOWN OF ARLINGTON
MIDDLESEX COUNTY,
MASSACHUSETTS
BOHLER
SOUTHBOROUGH, MA 01772
www.BohlerEngineering.com
EXHIBIT A
STREAM AND
BANK
EASEMENT
PLAN
SHEET TITLE:
RYDER BROOK
DEED
RESTRICTIONS
SHEET NUMBER:
EX-A
80
40
20
0
80
1"=80'
ALWAYS CALL 811
It's fast. It's free. It's the law.

EXHIBIT B

Stream Easement Area

COMMENCING AT THE SOUTHWESTERLY CORNER OF RYDER STREET (PRIVATE - 40' WIDE), SAID POINT BEING THE NORTHWESTERLY CORNER OF MAP 57, BLOCK 2, LOT 10B (N/F 1165R MASS MA PROPERTY, LLC), THENCE;

A. ALONG THE SOUTHERLY LINE OF RYDER STREET, ALONG THE DIVIDING LINE BETWEEN SAID LOT 10B AND MAP 57, BLOCK 2, LOT 11 (N/F ABCJ LAND, LLC), SOUTH 40 DEGREES - 22 MINUTES - 10 SECONDS EAST, A DISTANCE OF 203.42 FEET, THENCE;
B. DEPARTING SAID DIVIDING LINE, RUNNING THROUGH THE INTERIOR OF SAID LOT 10B, NORTH 57 DEGREES - 43 MINUTES - 30 SECONDS EAST, A DISTANCE OF 52.40 FEET TO THE POINT OF BEGINNING, THENCE CONTINUING THROUGH SAID INTERIOR OF LOT 10B THE FOLLOWING EIGHT (8) COURSES

1. NORTH 36 DEGREES - 07 MINUTES - 02 SECONDS WEST, A DISTANCE OF 10.01 FEET TO A POINT, THENCE;
2. NORTH 55 DEGREES - 54 MINUTES - 20 SECONDS EAST, A DISTANCE OF 100.43 FEET TO A POINT, THENCE;
3. SOUTH 41 DEGREES - 12 MINUTES - 55 SECONDS EAST, A DISTANCE OF 92.14 FEET TO A POINT, THENCE;
4. SOUTH 76 DEGREES - 37 MINUTES - 32 SECONDS EAST, A DISTANCE OF 10.35 FEET TO A POINT, THENCE;
5. SOUTH 41 DEGREES - 13 MINUTES - 52 SECONDS EAST, A DISTANCE OF 10.06 FEET TO A POINT, THENCE;
6. SOUTH 48 DEGREES - 47 MINUTES - 06 SECONDS WEST, A DISTANCE OF 15.53 FEET TO A POINT, THENCE;
7. NORTH 41 DEGREES - 14 MINUTES - 46 SECONDS WEST, A DISTANCE FO 101.76 FEET TO A POINT, THENCE;
8. SOUTH 55 DEGREES - 54 MINUTES - 20 SECONDS WEST, A DISTANCE OF 91.67 FEET TO THE POINT AND PLACE OF BEGINNING.

CONTAINING 2,062 SQUARE FEET 0.047 ACRES

EXHIBIT C

Bank Easement Area

COMMENCING AT THE SOUTHWESTERLY CORNER OF RYDER STREET (PRIVATE - 40' WIDE), SAID POINT BEING THE NORTHWESTERLY CORNER OF MAP 57, BLOCK 2, LOT 10B (N/F 1165R MASS MA PROPERTY, LLC), THENCE;

C. ALONG THE SOUTHERLY LINE OF RYDER STREET, ALONG THE DIVIDING LINE BETWEEN SAID LOT 10B AND MAP 57, BLOCK 2, LOT 11 (N/F ABCJ LAND, LLC), SOUTH 40 DEGREES - 22 MINUTES - 10 SECONDS EAST, A DISTANCE OF 203.42 FEET, THENCE;

D. DEPARTING SAID DIVIDING LINE, RUNNING THROUGH THE INTERIOR OF SAID LOT 10B, NORTH 57 DEGREES - 43 MINUTES - 30 SECONDS EAST, A DISTANCE OF 52.40 FEET TO THE POINT OF BEGINNING, THENCE CONTINUING THROUGH SAID INTERIOR OF LOT 10B THE FOLLOWING FOUR (4) COURSES

9. NORTH 55 DEGREES - 54 MINUTES - 20 SECONDS EAST, A DISTANCE OF 91.67 FEET TO A POINT, THENCE;

10. SOUTH 41 DEGREES - 14 MINUTES - 46 SECONDS EAST, A DISTANCE OF 3.02 FEET TO A POINT, THENCE;

11. SOUTH 55 DEGREES - 54 MINUTES - 20 SECONDS WEST, A DISTANCE OF 91.93 FEET TO A POINT, THENCE;

4. NORTH 36 DEGREES - 20 MINUTES - 30 SECONDS WEST, A DISTANCE OF 3.00 FEET TO THE POINT AND PLACE OF BEGINNING.

CONTAINING 276 SQUARE FEET 0.006 ACRES

and

COMMENCING AT THE SOUTHWESTERLY CORNER OF RYDER STREET (PRIVATE - 40' WIDE), SAID POINT BEING THE NORTHWESTERLY CORNER OF MAP 57, BLOCK 2, LOT 10B (N/F 1165R MASS MA PROPERTY, LLC), THENCE;

E. ALONG THE SOUTHERLY LINE OF RYDER STREET, ALONG THE DIVIDING LINE BETWEEN SAID LOT 10B AND MAP 57, BLOCK 2, LOT 11 (N/F ABCJ LAND, LLC), SOUTH 40 DEGREES - 22 MINUTES - 10 SECONDS EAST, A DISTANCE OF 203.42 FEET, THENCE;

F. DEPARTING SAID DIVIDING LINE, RUNNING THROUGH THE INTERIOR OF SAID LOT 10B, NORTH 64 DEGREES - 55 MINUTES - 18 SECONDS EAST, A DISTANCE OF 49.55 FEET TO THE POINT OF BEGINNING, THENCE CONTINUING THROUGH SAID INTERIOR OF LOT 10B THE FOLLOWING SIX (6) COURSES

12. NORTH 37 DEGREES - 12 MINUTES - 24 SECONDS WEST, A DISTANCE OF 2.60 FEET TO A POINT, THENCE;

13. NORTH 53 DEGREES - 37 MINUTES - 00 SECONDS EAST, A DISTANCE OF 105.82 FEET TO A POINT, THENCE;

14. SOUTH 41 DEGREES - 13 MINUTES - 52 SECONDS EAST, A DISTANCE OF 106.71 FEET TO A POINT, THENCE;

15. NORTH 76 DEGREES - 37 MINUTES - 32 SECONDS WEST, A DISTANCE OF 10.35 FEET TO A POINT, THENCE;

16. NORTH 41 DEGREES - 12 MINUTES - 55 SECONDS WEST, A DISTANCE OF 92.14 FEET TO A POINT, THENCE;

17. SOUTH 55 DEGREES - 54 MINUTES - 20 SECONDS WEST, A DISTANCE OF 100.43 FEET TO THE POINT AND PLACE OF BEGINNING.

CONTAINING 1,075 SQUARE FEET 0.025 ACRES

Town of Arlington, Massachusetts

Certificate of Compliance Request: 49 Spy Pond Lane.

Summary:
Certificate of Compliance Request: 49 Spy Pond Lane.

ATTACHMENTS:

	Type	File Name	Description
	Reference Material	49_Spy_Pond_Lane_COC_Package.pdf	49 Spy Pond Lane COC Package.pdf

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 8A – Request for Certificate of Compliance

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

DEP File Number:
091-0366
Provided by DEP

A. Project Information

Important:
When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

1. This request is being made by:

Kevin Blankespoor
Name

49 Spy Pond Ln
Mailing Address

Arlington
City/Town

MA
State

02474
Zip Code

617-378-2611
Phone Number

2. This request is in reference to work regulated by a final Order of Conditions issued to:

Kevin Blankespoor
Applicant

10/8/2024
Dated

091-0366
DEP File Number

Upon completion of the work authorized in an Order of Conditions, the property owner must request a Certificate of Compliance from the issuing authority stating that the work or portion of the work has been satisfactorily completed.

3. The project site is located at:

49 Spy Pond Ln
Street Address

Arlington
City/Town

12
Assessors Map/Plat Number

4-2.A
Parcel/Lot Number

4. The final Order of Conditions was recorded at the Registry of Deeds for:

Kevin Blankespoor
Property Owner (if different)

Middlesex
County

79194
Book

490
Page

Certificate (if registered land)

5. This request is for certification that (check one):

☒ the work regulated by the above-referenced Order of Conditions has been satisfactorily completed.

☐ the following portions of the work regulated by the above-referenced Order of Conditions have been satisfactorily completed (use additional paper if necessary).

☐ the above-referenced Order of Conditions has lapsed and is therefore no longer valid, and the work regulated by it was never started.

A. Project Information (cont.)

6. Did the Order of Conditions for this project, or the portion of the project subject to this request, contain an approval of any plans stamped by a registered professional engineer, architect, landscape architect, or land surveyor?

   ☐ Yes — If yes, attach a written statement by such a professional certifying substantial compliance with the plans and describing what deviation, if any, exists from the plans approved in the Order.

   ☒ No

B. Submittal Requirements

Requests for Certificates of Compliance should be directed to the issuing authority that issued the final Order of Conditions (OOC). If the project received an OOC from the Conservation Commission, submit this request to that Commission. If the project was issued a Superseding Order of Conditions or was the subject of an Adjudicatory Hearing Final Decision, submit this request to the appropriate DEP Regional Office (see http://www.mass.gov/eea/agencies/massdep/about/contacts/find-the-massdep-regional-office-for-your-city-or-town.html).

TOWN OF ARLINGTON

MASSACHUSETTS

CONSERVATION COMMISSION

CERTIFICATE OF COMPLIANCE CHECKLIST

Project Street Address: 49 Spy Pond Ln **DEP File No:** 091-0366

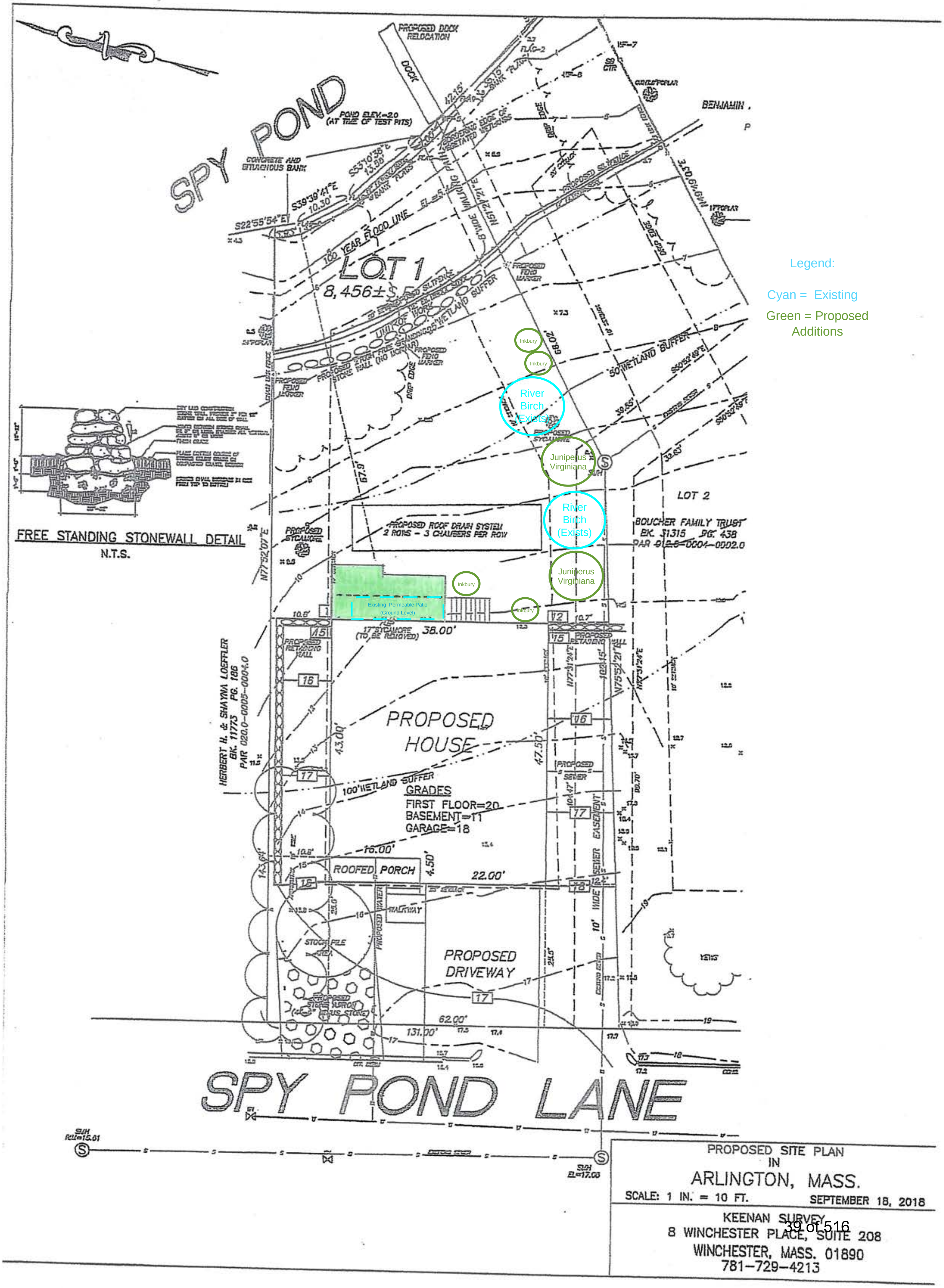
Applicant: Kevin Blankespoor **Site Visit Date:** 1/31/25

☐ All materials submitted and compliant with Order of Conditions		
As-built Plan	☐ Submitted ☐ Stamped ☐ Dated	
Special Conditions	☐ Additional materials required (Condition #_______) ☐ Additional materials submitted	
	Condition # 39	☑ Compliant ☐ Non-compliant
	Condition # 43	☑ Compliant ☐ Non-compliant
	Condition # 44	☑ Compliant ☐ Non-compliant
Project Narrative	☐ Notes changes	
Describe changes N/A		
Site Visit	☑ Site conditions acceptable ☐ Site conditions unacceptable	
Recommendation	☑ Issue Certificate of Compliance ☐ Do not issue Certificate of Compliance	

TOWN HALL, 730 MASSACHUSETTS AVENUE, ARLINGTON, MA 02476
(781) 316-3012

Special Conditions continued

Special Conditions	Condition # 45	☑ Compliant ☐ Non-compliant
	Condition #_______	☐ Compliant ☐ Non-compliant
	Condition #_______	☐ Compliant ☐ Non-compliant
	Condition #_______	☐ Compliant ☐ Non-compliant
	Condition #_______	☐ Compliant ☐ Non-compliant
	Condition #_______	☐ Compliant ☐ Non-compliant
	Condition #_______	☐ Compliant ☐ Non-compliant
	Condition #_______	☐ Compliant ☐ Non-compliant
	Condition #_______	☐ Compliant ☐ Non-compliant
	Condition #_______	☐ Compliant ☐ Non-compliant
	Condition #_______	☐ Compliant ☐ Non-compliant
	Condition #_______	☐ Compliant ☐ Non-compliant
	Condition #_______	☐ Compliant ☐ Non-compliant
	Condition #_______	☐ Compliant ☐ Non-compliant


SPY POND
POND ELEV.=20 (AT TIME OF TEST PITS)
PROPOSED DOCK RELOCATION
DOCK
CONCRETE AND BITUMINOUS BANK
100 YEAR FLOOD LINE
LOT 1
8,456± S.F.
PROPOSED SILTFENCE
50' WETLAND BUFFER
PROPOSED FREE STANDING STONE WALL (NO MORTAR)
PROPOSED FENO MARKER
DRIP EDGE
BENJAMIN
Legend:
Cyan = Existing
Green = Proposed Additions
Inkbury
River Birch (Exists)
Juniperus Virginiana
PROPOSED SYCAMORE
LOT 2
BOUCHER FAMILY TRUST
BK. 51315 PG. 438
PROPOSED ROOF DRAIN SYSTEM 2 ROWS - 3 CHAMBERS PER ROW
Existing Permeable Patio (Ground Level)
17" SYCAMORE (TO BE REMOVED)
38.00'
PROPOSED RETAINING WALL
FREE STANDING STONEWALL DETAIL
N.T.S.
HERBERT H. & SHAYNA LOEFFLER
BK. 11773 PG. 186
PAR 020.0-0005-0004.0
PROPOSED HOUSE
100' WETLAND BUFFER
GRADES
FIRST FLOOR=20
BASEMENT=11
GARAGE=18
43.00'
47.50'
16.00'
ROOFED PORCH
22.00'
WALKWAY
STOCK PILE AREA
PROPOSED DRIVEWAY
10' WIDE SEWER EASEMENT
PROPOSED SEWER
YEWS
62.00'
131.00'
SPY POND LANE
PROPOSED SITE PLAN
IN
ARLINGTON, MASS.
SCALE: 1 IN. = 10 FT.
SEPTEMBER 18, 2018
KEENAN SURVEY
8 WINCHESTER PLACE, SUITE 208
WINCHESTER, MASS. 01890
781-729-4213

TOWN OF ARLINGTON

MASSACHUSETTS

CONSERVATION COMMISSION

SITE VISIT SUMMARY

This document serves as a legal notice of the Arlington Conservation Commission's findings on a recent site visit. Questions concerning this notice should be directed to the Arlington Conservation Commission, telephone 781-316-3012

A. Location of Site Visit: 49 Spy Pond Lane

B. Attendees Present: David Morgan, Jackie Anderson

C. Date of Site Visit: 01.31.25

D. Reason for Site Visit: COC

E. Findings: Site built to spec, 100% survival of all mitigation plantings

F. Required Actions:
- ☐ Cease immediately all work on the property
- ☐ Call the office to discuss the matter by ___________
- ☐ Attend the ________ meeting of the Conservation Commission to discuss the matter. Call the office for details.
- ☒ No action required

G. Follow-up Site Visit: N/A

A representative from the Arlington Conservation Commission will conduct a follow-up site visit to ensure continued compliance on or after the date listed above unless you call the office at 781-316-3012 to schedule a specific date and time for the site visit. Please feel free to call the office to discuss the matter.

H. Issuing Agent of the Commission

Signature: ______________________ Date: 01.31.25

Printed name: **David Morgan, Environmental Planner + Conservation Agent**

Town of Arlington, Massachusetts

Enforcement Order: 40 Park Avenue.

Summary:
Enforcement Order: 40 Park Avenue.

ATTACHMENTS:

	Type	File Name	Description
🗋	Reference Material	40_Park_Avenue_-_Draft_Restoration_Plan.pdf	40 Park Avenue - Draft Restoration Plan.pdf

January 27, 2025

Electronic & Hand Delivery

Arlington Conservation Commission
Arlington Town Hall Annex
730 Massachusetts Avenue
Arlington, MA 02476

Re: Restoration Plan [LEC File #: PAALLP\24-453.02]
40 Park Avenue
Arlington, Massachusetts

Dear Members of the Conservation Commission:

On behalf of the Property Owner, 30 Park Avenue Associates, LLC, LEC Environmental Consultants, Inc., (LEC) is submitting this letter describing the proposed *Restoration Plan* being provided as a response to an Enforcement Order (EO) issued by the Arlington Conservation Commission on September 17, 2024 (and subsequently modified by vote at the public meeting on December 19, 2024), for unauthorized vegetation clearing and tree cutting within the 40 Park Avenue property (Parcel ID 59-1-10.B). The *Restoration Plan* has been prepared in accordance with the vegetation replacement section of the *Town of Arlington Wetlands Protection Regulations* (the *Bylaw Regulations).* Please find attached the *Restoration Plan*, dated January 27, 2025, prepared by LEC (Attachment A).

Note that the *Restoration Plan* also includes restoration for the associated vegetation removal that took place on the property to the immediate east, known as 1293-1305 Massachusetts Avenue (Parcel ID 59-1-10.D), owned by P&D Realty. 30 Park Avenue Associates has written permission from P&D Realty to perform the restoration activities. In compliance with the original EO, erosion control socks were installed in October 2024 and remain in place to prevent any sedimentation or runoff into the Brook.

Proposed Restoration Plan

The *Restoration Plan* includes the planting of native, non-cultivar tree and shrub species within the 25-foot No Disturbance Zone to Mill Brook. Compliance with the vegetation replacement section of the *Bylaw Regulations* is discussed below.

The Owner proposes to restore and enhance the affected portion of Riverfront Area adjacent to the Mill Brook in the southeastern portion of the 40 Park Avenue property and northwestern portion of the 1293-1305 Massachusetts Avenue property by installing native trees and shrubs. Specifically, the existing disturbed ground surface will be planted with 10 native trees (5 red maples and 5 American elm) and 8 native shrubs (4 highbush blueberry and 4 winterberry). The native plantings are derived from the

LEC

Recommended Native Plant Materials List published by the Arlington Conservation Commission in 2014. Existing stumps will remain in place, to provide stability to the steep slopes leading down to the Mill Brook. Trees will be minimum 1.5" DBH, and shrubs will be minimum 24" tall.

This restoration effort intends to improve the function and value of the Riverfront Area and Adjacent Upland Resource Area compared to pre-existing conditions by establishing a dedicated, monitored and maintained restoration/enhancement area that will stabilize the riparian slopes, diversify the plant community composition of the area, and provide a natural filtering system for rainwater before entering the Brook. A series of markers will define the outer limit of the restoration area and will discourage future encroachment into the 25-foot No Disturb Zone.

The species of the removed vegetation could not be identified by the remnant stumps or woody debris during LEC's site investigations; however, photos of the area from summer 2024 provided by the Owner suggest that the impacted area was densely vegetated with invasive poison ivy and non-native vines such as Oriental bittersweet, and based on existing trees in the surrounding area, many, if not all the trees may have also been non-native. What is clear is that a large tree fell on a car, which necessitated some amount of tree clearing for the interest of public safety and prevention of further property damage. Given that the 40 Park Avenue property is quite small and mostly developed, there is limited space onsite for additional replacement trees. Further, there are numerous monitoring wells that need to remain accessible, further limiting the extent of available space for new plantings. The northerly portion of the properties is a combination of pavement and sandy, compacted fill, so this is not suitable for vegetation planting. Part of the *Restoration Plan* includes designating an area of snow storage in an area where cars have historically parked (unauthorized) for the fitness center to the north.

The proposed *Restoration Plan* will improve the natural capacity of the Riverfront and Adjacent Upland Resource Area to protect and promote the interests of the *Bylaw*, and is commensurate with the magnitude and extent of vegetation removed. The restoration area and replacement plantings will be monitored for survivability for three growing seasons by a qualified consultant as specified in the *Bylaw Regulations*.

Section 25 Vegetation Replacement Compliance

The proposed *Restoration Plan* has been designed to comply to the greatest extent possible with the vegetation removal and replacement standards outlined in Section 25(f)(b) of the *Bylaw Regulations* as outlined and discussed below.

B. Standards

1) *No vegetation in a resource area protected by the Bylaw shall be damaged, extensively pruned, or removed without written approval by the Commission and, if approval is granted, with in-kind replacement (as defined below).*

   The Owner proposes in-kind replacement of the trees and vegetation that were removed without the Commission's approval. Tree replacement in accordance with the *Bylaw Regulations* is discussed below.

2) *Extensive pruning is defined as removal of 20% or more of limbs or growth. For extensive pruning or removal of vegetation because of an Imminent Risk to Public Health and Safety, in-kind replacement shall be to the extent practicable as determined by the Commission (See Section 10 of these Regulations for Emergency Certification or Section 7 of these Regulations for Administrative Review).*

   No tree pruning of trees >20% of limbs or growth is proposed.

3) *Vegetation replacement shall conform with Section 25.F and is not considered successful until the replacement plants have survived three full growing seasons.*

   Conformance with Section 25.F is provided below. The Owner proposes to have a qualified professional monitor the replacement trees for three full growing seasons and complete yearly monitoring reports documenting the status of the replacement plantings.

D. In administering this standard, the Commission shall consider species selection, location and timing of the plantings, compliance with the Replacement Standards in Section 25.F and the following.

1) *Whether existing vegetation is in a state of irreversible decay, or invasive vegetation is present.*

   A high percentage of the pre-existing vegetation was rotting trees and invasive vegetation.

2) *Whether a bank or slope stabilization plan requires the restructuring of soils occupied by the vegetation to be removed.*

   Much of the affected area contains poor-quality fill soils. Proper healthy soils will be brought in to ensure all trees and shrubs are planted in soils that will provide for long-term health.

3) *Whether the vegetation being removed is an aggressive, invasive non-native species as listed on a wetlands plant list acceptable to the Commission, such as, but not limited to that published by the Massachusetts Invasive Plant Advisory Group or the United States Fish and Wildlife Service.*

   See #1 above.

4) *Ecological Restoration The vegetation is being removed as part of a project whose primary purpose is to restore or otherwise improve the natural capacity of a resource area to protect and promote the interests of the Bylaw; also called a Resource Area Enhancement project.*

   This Restoration Plan is an Ecological Restoration project that aims to restore and improve upon the pre-existing conditions of the affected portion of Riverfront Area.

5) *Vegetation Replacement: The vegetation is being removed and replaced elsewhere on the project site or within the same resource area. This is subject to the Commission's determination that such removal and replacement does not decrease the resource area's contribution to the resource area values protected by the Bylaw.*

   N/A.

6) *Imminent Risk to Public Health and Safety: The vegetation is an imminent risk to public health or safety or property as confirmed in writing and submitted to the Commission by the Arlington Tree Waden, Fire Department, Public Safety Officer, or a certified arborist.*

   As described above, and documented in a police report, part of the reasoning for the removal of large, dead or dying trees, was the falling of a limb on a vehicle parked on the property.

7) *Any proposed removal and replacement of vegetation complies with the Replacement Standards in Section 25.F, below.*

   Discussion below.

F. Replacement Standards

(1) Replacement Requirements for Trees and Shrubs

a. Tree and shrub replacement is allowed in the regulatory floodway.

(2) Replacement Requirements for Trees

a. Table F.1 indicates requirements for replacement quantity of trees based on the size of existing tree being removed.

Table F.1. Tree Replacement Requirements

Existing Tree	Replacement Quantity
Deciduous dbh[1] < 1.5" Evergreen height[2] < 4'	0[3]
Deciduous dbh 1.5" to 6" Evergreen height 4' to 6'	2
Deciduous dbh 6" to 10" Evergreen height 6' to 10'	3
Deciduous dbh > 10" Evergreen height > 10'	≥ 4 at discretion of Commission

[1] dbh = diameter at breast height (4' 6" above the ground)
[2] Evergreen trees because of their dense branches and needles are generally measured based on their height and width
[3] Sapling trees shall include deciduous trees with a dbh of 1.5 inches and less (or caliper equivalent) and evergreens of 2 feet or less and shall be replaced at the discretion of the Commission. Replacement Deciduous trees must be a minimum of 1.5" dbh (or caliper equivalent); replacement Evergreen trees must be a minimum of 4' in height.

According to the existing conditions survey titled "Conservation Plan", prepared by Rober Survey, dated October 28, 2024, 16 stumps were located, ranging in diameter from 4" to 53". LEC cannot verify if the stumps shown on the plan all represent trees removed by the Owner in 2024. Most of the stumps are noted to have a diameter of greater than or equal to 10" DBH, which corresponds to the 4:1 replacement category in Table F.1. A strict compliance with this table would require the planting of 59 trees. As discussed above, the Owner requests relief from this strict requirement and consideration of the proposed, reduced number of trees and shrubs given the space constraints, and the poor quality of the pre-existing vegetation including invasive species and diseased, or dead trees. The proposed restoration of the Riverfront Area is commensurate with the area impacted, and will make the location better at protecting the *Bylaw* interests than what was there prior to the disturbance.

b. *Replacement Deciduous trees must be a minimum of 1.5" dbh (or caliper equivalent); replacement Evergreen trees must be a minimum of 4' in height.*

Replacement trees will be at least 1.5" dbh.

c. *If a plant is healthy with a single stem, well-shaped and bushy, has sufficient well-spaced side branches to give it weight and good bud qualities, and conforms to the requirements described in the latest edition of American Standard for Nursery Stock, published by the American Association of Nurseryman (ANN), then it is an acceptable plant.*

All plantings will be healthy and conform to the American Standard for Nursery Stock.

d. *All replacement plants shall have ball sizes which are of a diameter and depth to encompass enough of the fibrous and feeding root system as necessary for the full recovery of the plant once planted.*

All plantings will have the proper ball size when planted.

e. *Plants over 14' should not be container grown.*

No plants over 14' will be planted.

Thank you for your consideration of this Supplemental Information. We look forward to meeting with you at the March 6, 2025 Public Hearing. If you have any questions in the meantime, please do not hesitate to contact me in our Wakefield office at 781-245-2500 or at dwells@lecenvironmental.com.

Sincerely,

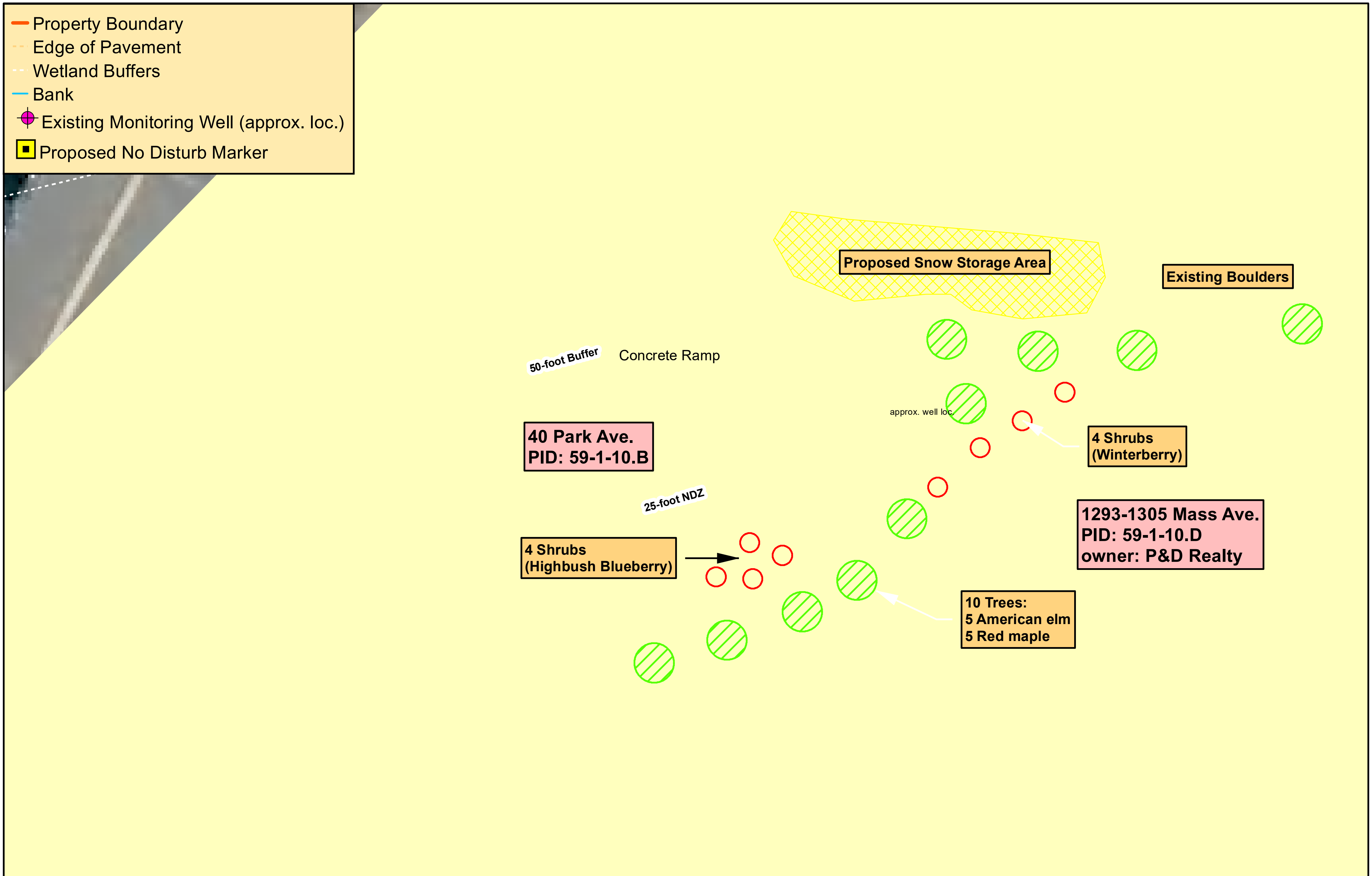
LEC Environmental Consultants, Inc.

Dan Wells

Dan Wells
Senior Wildlife/Wetland Scientist

Attachment A

Restoration Plan,
dated January 27, 2025
prepared by LEC



LEC Environmental Consultants, Inc.
Wakefield, MA 781.245.2500
www.lecenvironmental.com

Restoration Plan

40 Park Avenue
Arlington, MA

Date: 1/27/2025

N

1 inch = 20 feet

0 5 10 20 Feet

Town of Arlington, Massachusetts

DEP #091-0356: Notice of Intent: Thorndike Place (Continued from 01/16/2025).

Summary:
DEP #091-0356: Notice of Intent: Thorndike Place (Continued from 01/16/2025).
The Conservation Commission will hold a public hearing under the Wetlands Protection Act to consider a Notice of Intent for the construction of Thorndike Place, a multifamily development on Dorothy Road in Arlington. Areas proposed to be altered include Buffer Zone to Bordering Vegetated Wetland and Bordering Land Subject to Flooding associated with Alewife Brook.

ATTACHMENTS:

Type	File Name	Description
Reference Material	Thorndike_Place_-_GZA_-_Response_to_Stormwater_System_Redesign.pdf	Thorndike Place - GZA - Response to Stormwater System Redesign.pdf
Reference Material	Thorndike_Place_-_BSC_-_Revisions_to_Stormwater_Management_and_Response_to_Peer_Review__including_ISMP.pdf	Thorndike Place - BSC - Revisions to Stormwater Management and Response to Peer Review, including ISMP.pdf

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F: 401.751.8613
www.gza.com

January 28, 2025
File No. 03.0035410.00

Mr. David Morgan
Environmental Planner and Conservation Agent
Arlington Town Hall
730 Massachusetts Avenue
Arlington, MA 02467

Re: Response to January 2025 Redesign
Peer Review of Stormwater Mound Evaluation
Proposed Thorndike Place Residential Development
Arlington, Massachusetts

Dear Mr. Morgan:

In accordance with your request, GZA GeoEnvironmental, Inc. (GZA) prepared this letter to address the BSC Group (BSC)'s January 2025 revised stormwater infiltration design and groundwater mounding analysis associated with the proposed Thorndike Place residential development in Arlington, Massachusetts (the "Site"). BSC performed their work on behalf of the Applicant (Arlington Land Realty, LLC). This letter report is subject to the Limitations provided in **Appendix A.**

BACKGROUND

BSC's June 10, 2024 letter report provided a stormwater mound evaluation and a recommended design groundwater elevation for the Site. GZA's August 1, 2024 peer review of that report recommended that the stormwater infiltration system be redesigned to account for the impacts of groundwater mounding during large storm events and to meet the MassDEP Stormwater Manual's maximum allowable drainage standard of 72-hours. In addition, the redesign was to address peak flow rates that discharge to the stormwater outfall control system (i.e., MassDEP Stormwater Standard 2- Peak Rate attenuation).

BSC subsequently prepared a response letter dated October 4, 2024 that provided a revised stormwater design and associated mounding analysis. GZA's response to that letter, and response to Scott Horsely's August 23, 2024 comment letter, was provided in a letter report dated October 22, 2024.

Thereafter, at the October 24, 2024 public hearing on the Project, GZA requested that the groundwater mound analysis for the underground infiltration system be performed based on the total volume of water infiltrated during the 100 year, 24-hour storm event.

BSC RESPONSE AND REDESIGN

BSC subsequently prepared a response letter dated January 3, 2025 that provided a revised stormwater design and associated mounding analysis. The revised design includes:

1. Five small underground infiltration systems (Infiltration Systems 2 to 6) located in the townhouse driveways near Dorothy Avenue. These systems are located 3.0 feet above the

estimated seasonal high-water table (ESHWT) and include groundwater mound estimates. In larger storm events these systems overflow to a larger underground infiltration system (Infiltration System 1).

2. The former primary infiltration system was modified into two (2) separate underground infiltration systems (Infiltration System 1 and Infiltration System 7).

    a. Infiltration System 1 has a bottom elevation of 8.0 feet which is 4.0 feet above the ESHWT. Because of this 4.0-foot separation distance, a groundwater mound estimate was not provided because it was not required per DEP's Massachusetts Stormwater Handbook. A drawdown analysis using the full volume of water below the lowest system outlet (elevation 9.22 feet) indicates the system will drain in less than the required 72-hours. In larger storm events this system overflows via outlet control structures to a downstream outfall location.

    b. Infiltration System 7 has a bottom elevation of 7.15 feet which is 3.15 feet above the ESHWT and includes a groundwater mound estimate. In larger storm events this system overflows via outlet control structures to a downstream outfall location.

Note that the rooftop detention system that was previously planned for a portion of the multi-unit building roof has been eliminated from the design.

Two new test borings (MA-1 and MA-2) were performed in the area of proposed Infiltration Systems 1 and 7 on November 20, 2024. The test boring logs and a figure depicting the location of the test borings is provided in **Appendix B**. These borings were performed to better understand the depth to a restrictive layer to more accurately determine the initial saturated thickness to be used in the groundwater mounding analysis. The previous groundwater analysis was performed using a saturated thickness of 5 feet, which represented the maximum depth of the test pits below the ESHWT. The two new borings showed a marine clay layer with a highest elevation between -12.1 and -17.4 feet. Based on that data, BSC used an aquifer saturated thickness in their mounding analysis of 16 feet representing the depth between the ESHWT (4.0) and the shallower marine clay layer (-12.1).

BSC's revised peak stormwater flow calculations provided in their January 3, 2025 letter indicated that post development flows remain less than predevelopment flows, which satisfies MassDEP's Stormwater Standard 2.

The locations of proposed Site features are shown on the figure provided in **Appendix C**.

GZA RESPONSE

The Massachusetts Stormwater Handbook states:

> *Mounding analysis is required when the vertical separation from the bottom of an exfiltration system to seasonal high groundwater is less than four (4) feet and the recharge system is proposed to attenuate the peak discharge from a 10-year or higher 24-hour storm (e.g., 10-year, 25 year, or 100-year 24- hour storm). In such cases, the mounding analysis must demonstrate that the Required Recharge Volume (e.g., infiltration basin storage) is fully dewatered with 72 hours (so the next storm can be stored for exfiltration).*

The revised underground stormwater Infiltration System 1 is now 4.0 feet above the ESHWT. As a result, GZA agrees that a groundwater mound evaluation is not required by the MassDEP Stormwater Standards for this system.

GZA's review of the new test boring logs (MA-1 to MA-2) provided in Appendix B indicate that below the upper fill strata, alluvium deposits of stratified sand deposits with trace amounts of silt, and silty sand deposits were encountered in both borings to a depth of 20 to 28 feet below grade (elevation -12 to -17 feet), at which point a low permeability clay layer was encountered. The deeper clay strata was encountered at boring MA-1 which was performed in the area of proposed Infiltration System 7. It is GZA's opinion that this new subsurface information indicates that using an aquifer saturated thickness of 16 feet in the groundwater mound analysis, instead of the previous 5-foot thickness, is a reasonable assumption.

However, we note that a fibrous peat (organic deposit) was encountered in boring MA-2 between a depth of 5.5 and 8 feet (elevation 2.4 to -0.1 feet). Boring MA-2 was performed on the eastern side of Infiltration System 1. It is GZA's opinion that the organic deposit encountered beneath the eastern portion of Infiltration System 1 is a low permeability deposit that may adversely impact the functionality of Infiltration System 1. GZA recommends that the organic deposit be removed from the area of Infiltration System 1 and then be replaced with clean sand backfill up to the bottom of Infiltration System 1.

We note that the bottom of stormwater Infiltration System 1 is now higher than the proposed garage floor level of the new building that is planned to be located 10 feet from the stormwater infiltration system. The proposed garage floor level is elevation 6.0 feet, and the bottom of the stormwater infiltration system is planned to be at elevation 8.0 feet. It is GZA's opinion, that a groundwater underdrain should be designed and constructed beneath the garage floor level in this area to prevent potential water seepage into the building foundation and / or floor slab.

BSC's groundwater mound evaluations for Infiltration Systems 2 to 7, using the volume of groundwater recharge generated during the 100-year storm event, used the same aquifer parameter as the previous analysis but with an aquifer thickness of 16 feet.

Their groundwater mound estimate was 0.76 feet for Infiltration Systems 2 to 6 (i.e., the smaller systems located in the townhouse driveways) which was less than the separation distance of 3.0 feet between the ESHWT and the bottom of the infiltration system. BSC assumed that the entire groundwater recharge volume of 161 cubic feet of water was applied to the 100.7 square foot bottom area of the infiltration system over a one-day period, resulting in an applied recharge rate of 1.60 feet per day. We note that the design vertical hydraulic conductivity value of 0.27-inches per hour (0.54 feet per day) would tend to slow the applied recharge rate to 0.54 feet per day, which would take 2.95 days to drain. GZA performed a groundwater mound analysis using the 0.54 feet per day groundwater recharge rate with a duration of 2.95 days, which resulted in an estimated groundwater mound of 0.31 feet (less than BSC's estimate). Our mound calculations are provided in **Appendix D**.

BSC's groundwater mound estimate was 2.95 feet for Infiltration System 7 which was less than the separation distance of 3.15 feet between the ESHWT and the bottom of the infiltration system. BSC assumed that the entire groundwater recharge volume of 1,606 cubic feet of water was applied to the 2,422 square foot bottom area of the infiltration system over a one-day period, resulting in an applied recharge rate of 0.66 feet per day. We again note that the design vertical hydraulic conductivity value of 0.27-inches per hour (0.54 feet per day) would tend to slow the applied recharge rate to 0.54 feet per day, which would take 1.23 days to drain. GZA performed our groundwater mound analysis using the 0.54 feet per day groundwater recharge rate with a duration of 1.23 days, which resulted in an estimated groundwater mound of 2.62 feet (less than BSC's estimate). Our mound calculations are provided in **Appendix D**.

We note that Infiltration System 7 is about 18 feet west of Infiltration System 1. Due to this proximity, the discharge of stormwater to Infiltration System 1 may have some affect on the groundwater levels beneath Infiltration System 7. However, GZA's mound estimate of 2.62 feet is 0.53 feet lower than the bottom of Infiltration System 7, so there is

additional vertical separation from the bottom of the system and the estimated mound height to account for additional mounding impacts.

CONCLUSIONS

GZA's opinion is as follows:

1. If the nearby building's groundwater underdrain system is installed beside Infiltration System 1 and if the organic deposit (peat layer) in the eastern portion of the Infiltration System 1 is removed and replaced with clean sand up to the bottom of the Infiltration System 1, then we do not anticipate that the adjacent mounding due to Infiltration System 1 will adversely impact the mound conditions at Infiltration System 7.

2. With the implementation of building underdrainage and peat removal as summarized above, the revised stormwater mound evaluations provided in BSC's January 3, 2025 report adequately addresses the Massachusetts Stormwater Handbook's requirements to evaluate impacts of groundwater mounding during large (100-year) storm events and addresses the 72-hour drainage requirement for the infiltration systems. The revised predicted groundwater mound beneath the stormwater infiltration systems is not expected to adversely impact the ability of the infiltration systems to empty in less than 72 hours. We premise these conclusions on the assumption that an underdrain system will be installed beneath the building located near Infiltration System 1 and the organic deposit (peat layer) underlying Infiltration System 1 is removed and replaced with clean sand up to the bottom of the Infiltration System 1.

3. The stormwater redesign appears to adequately addresses the MassDEP Stormwater Standard 2- Peak Rate attenuation requirements.

We trust this information satisfies your current needs. If you have any questions or comments, please feel free to contact the undersigned at (401) 374-2317 or via email at anthony.urbano@gza.com.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

Anthony Urbano

Anthony B. Urbano, P.E.
Senior Project Manager

Todd Greene

Todd Greene, P.E.(RI)
Principal

Attachments: Appendix A – Limitations
Appendix B – New Boring Logs and Exploration Location Plan
Appendix C – Site Location Plan
Appendix D – GZA Groundwater Mound Calculations

Jobs/env/35410.ABU/correspondence/Response to Jan 2025 Redesign/35410-response to redesign 1-28-25.docx

ATTACHMENT A

Limitations

USE OF REPORT

1. GZA GeoEnvironmental, Inc. (GZA) prepared this report on behalf of, and for the exclusive use of our Client for the stated purpose(s) and location(s) identified in the Proposal for Services and/or Report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not expressly identified in the agreement, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

STANDARD OF CARE

2. GZA's findings and conclusions are based on the work conducted as part of the Scope of Services set forth in the Proposal for Services and/or Report and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning the limited data gathered during the course of our work. Conditions other than described in this report may be found at the subject location(s).

3. GZA's services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services, at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made. Specifically, GZA does not and cannot represent that the Site contains no hazardous material, oil, or other latent condition beyond that observed by GZA during its study. Additionally, GZA makes no warranty that any response action or recommended action will achieve all of its objectives or that the findings of this study will be upheld by a local, state or federal agency.

4. In conducting our work, GZA relied upon certain information made available by public agencies, Client and/or others. GZA did not attempt to independently verify the accuracy or completeness of that information. Inconsistencies in this information which we have noted, if any, are discussed in the Report.

SUBSURFACE CONDITIONS

5. The generalized soil profile(s) provided in our Report are based on widely-spaced subsurface explorations and are intended only to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized, and were based on our assessment of subsurface conditions. The composition of strata, and the transitions between strata, may be more variable and more complex than indicated. For more specific information on soil conditions at a specific location refer to the exploration logs. The nature and extent of variations between these explorations may not become evident until further exploration or construction. If variations or other latent conditions then become evident, it will be necessary to reevaluate the conclusions and recommendations of this report.

6. Water level readings have been made, as described in this Report, in and monitoring wells at the specified times and under the stated conditions. These data have been reviewed and interpretations have been made in this report. Fluctuations in the level of the groundwater however occur due to temporal or spatial variations in areal recharge rates, tidal fluctuations, soil heterogeneities, the presence of subsurface utilities, and/or natural or artificially induced perturbations. The observed water table may be other than indicated in the Report.

COMPLIANCE WITH CODES AND REGULATIONS

7. We used reasonable care in identifying and interpreting applicable codes and regulations necessary to execute our scope of work. These codes and regulations are subject to various, and possibly contradictory, interpretations. Interpretations and compliance with codes and regulations by other parties is beyond our control.

SCREENING AND ANALYTICAL TESTING

8. GZA collected environmental samples at the locations identified in the Report. These samples were analyzed for the specific parameters identified in the report. Additional constituents, for which analyses were not conducted, may be present in soil, groundwater, surface water, sediment and/or air. Future Site activities and uses may result in a requirement for additional testing.

9. Our interpretation of field screening and laboratory data is presented in the Report. Unless otherwise noted, we relied upon the laboratory's QA/QC program to validate these data.

10. Variations in the types and concentrations of contaminants observed at a given location or time may occur due to release mechanisms, disposal practices, changes in flow paths, and/or the influence of various physical, chemical, biological or radiological processes. Subsequently observed concentrations may be other than indicated in the Report.

INTERPRETATION OF DATA

11. Our opinions are based on available information as described in the Report, and on our professional judgment. Additional observations made over time, and/or space, may not support the opinions provided in the Report.

ADDITIONAL INFORMATION

12. In the event that the Client or others authorized to use this report obtain additional information on environmental or hazardous waste issues at the Site not contained in this report, such information shall be brought to GZA's attention forthwith. GZA will evaluate such information and, on the basis of this evaluation, may modify the conclusions stated in this report.

ADDITIONAL SERVICES

13. GZA recommends that we be retained to provide services during any future investigations, design, implementation activities, construction, and/or property development/ redevelopment at the Site. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design; and iv) assess the consequences of changes in technologies and/or regulations.

ATTACHMENT B

New Boring Logs and Exploration Location Plan

Project:	Thorndike Place	Job #:	7679.2.01	Boring No.
Location:	See Plan	Date Started:	11-20-24	**MA-1**
City/State:	Arlington, Massachusetts	Date Finished:	11-20-24	

Contractor: Carr-Dee Corp
Driller/Helper: J. DeSimone/C. Smith
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): 11.1
Casing Type/Depth (ft): 2.25" I.D. HSA/NW Casing
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
11-20-24	12	-0.9	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	N-Value	No.	Pen./Rec. (in)	Depth (ft)	Blows Per 6"	Sample Description and Boring Notes
1	10			FILL	12	S-1	24/8	0.0-2.0	3 5 7 12	Compact light brown silty SAND and GRAVEL. (FILL)
2	9									
3	8									
4	7									
5	6				70	S-2	24/16	5.0-7.0	14 37 33 49	Very dense, gray-brown SAND and GRAVEL, trace to some silt to BRICK. (FILL)
6	5									
7	4									
8	3									
9	2		9.5 / 1.6							
10	1			ALLUVIUM DEPOSIT	19	S-3	24/0	10.0-12.0	16 12 7 14	No Recovery
11	0									
12	-1				45	S-4	24/14	12.0-14.0	14 23 22 20	Dense, dark gray SAND, trace to some silt. (ALLUVIUM DEPOSIT)
13	-2									
14	-3									
15	-4				23	S-5	24/12	15.0-17.0	9 12 11 12	Compact, gray-brown SAND, trace silt. (ALLUVIUM DEPOSIT)
16	-5									
17	-6									
18	-7									
19	-8									
20	-9				17	S-6	24/18	20.0-22.0	8 8 9 12	Compact, orange-brown and yellow-brown stratified silty SAND to SAND, trace silt. (ALLUVIUM DEPOSIT)
21	-10									
22	-11									

GRANULAR SOILS

BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS

BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
1. Used Automatic Hammer for SPT.
2. Drillers switched to casing after obtaining sample from 12-14'.

Weather: Variable

McPHAIL ASSOCIATES, LLC
McPHAIL ASSOCIATES, LLC
42 3rd AVENUE
Burlington, MA 01803
TEL: 617-868-1420
FAX: 617-868-1423

Page 1 of 2

Project: Thorndike Place	**Job #:** 7679.2.01	Boring No.
Location: See Plan	**Date Started:** 11-20-24	**MA-1**
City/State: Arlington, Massachusetts	**Date Finished:** 11-20-24	

Contractor: Carr-Dee Corp
Driller/Helper: J. DeSimone/C. Smith
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): 11.1
Casing Type/Depth (ft): 2.25" I.D. HSA/NW Casing
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
11-20-24	12	-0.9	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	N-Value	No.	Pen./Rec. (in)	Depth (ft)	Blows Per 6"	Sample Description and Boring Notes
24	-13			ALLUVIUM DEPOSIT						
25	-14				33	S-7	24/18	25.0-27.0	19 17 16 15	Dense, gray stratified silty SAND to SAND, trace silt. (ALLUVIUM DEPOSIT)
26	-15									
27	-16									
28	-17		28.5 / -17.4							
29	-18			MARINE CLAY						
30	-19				9	S-8	24/18	30.0-32.0	3 4 5 3	Stiff, gray silty CLAY with ~ 6 inch layer of sand. (MARINE CLAY)
31	-20									
32	-21									
33	-22									
34	-23									
35	-24				1/24"	S-9	24/22	35.0-37.0	1/24"	Very soft, gray silty CLAY. (MARINE CLAY)
36	-25									
37	-26		37.0 / -25.9	Bottom of Borehole at 37.0 feet below existing grade.						
38	-27									
39	-28									
40	-29									
41	-30									
42	-31									
43	-32									
44	-33									
45	-34									

GRANULAR SOILS

BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS

BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
1. Used Automatic Hammer for SPT.
2. Drillers switched to casing after obtaining sample from 12-14'.

Weather: Variable

McPHAIL ASSOCIATES, LLC
42 3rd AVENUE
Burlington, MA 01803
TEL: 617-868-1420
FAX: 617-868-1423

Project: Thorndike Place	**Job #:** 7679.2.01	Boring No.
Location: See Plan	**Date Started:** 11-20-24	**MA-2**
City/State: Arlington, Massachusetts	**Date Finished:** 11-20-24	

Contractor: Carr-Dee Corp	**Casing Type/Depth (ft):** 2.25" I.D. HSA/NW Casing
Driller/Helper: J. DeSimone/C. Smith	**Casing Hammer (lbs)/Drop (in):** 300 lbs./24 inches
Logged By/Reviewed By: T. M. Cormican	**Sampler Size/Type:** 1-3/8" I.D. Split Spoon
Surface Elevation (ft): 7.9	**Sampler Hammer (lbs)/Drop (in):** 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
11-20-24	11	-3.1	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value	No.	Pen./Rec. (in)	Depth (ft)	Blows Per 6"	Sample Description and Boring Notes
			23.5 / -15.6	MARINE SAND						
24	-16									
25	-17									
26	-18				2	S-6	24/24	25.0-27.0	1/12' 1 1	Very soft, gray silty CLAY with frequent sand partings in bottom ~ 10 inches of sample. (MARINE CLAY)
27	-19									
28	-20									
29	-21									
30	-22									
31	-23				1	S-7	24/24	30.0-32.0	WOH WOH 1 1	Very soft, gray silty CLAY with frequent sand partings. (MARINE CLAY)
32	-24									
33	-25			MARINE CLAY						
34	-26									
35	-27									
36	-28				1	S-8	24/24	35.0-37.0	WOH WOH 1 1	Very soft, gray silty CLAY, with occasional sand partings. (MARINE CLAY)
37	-29									
38	-30									
39	-31									
40	-32									
41	-33				1	S-9	24/24	40.0-42.0	WOH WOH 1 WOH	Very soft, gray silty CLAY, with occasional sand partings. (MARINE CLAY)
42	-34		42.0 / -34.1							
43	-35			Bottom of Borehole at 42.0 feet below existing grade.						
44	-36									
45	-37									

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
1. Used Automatic Hammer for SPT.
2. Drillers switched to casing after obtaining sample from 10-12'.

Weather: Variable

McPHAIL ASSOCIATES, LLC
42 3rd AVENUE
Burlington, MA 01803
TEL: 617-868-1420
FAX: 617-868-1423

Project:	Thorndike Place	**Job #:**	7679.2.01
Location:	See Plan	**Date Started:**	11-20-24
City/State:	Arlington, Massachusetts	**Date Finished:**	11-20-24

Boring No.

MA-2

Contractor: Carr-Dee Corp
Driller/Helper: J. DeSimone/C. Smith
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): 7.9

Casing Type/Depth (ft): 2.25" I.D. HSA/NW Casing
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations			
Date	Depth	Elev.	Notes
11-20-24	11	-3.1	

Depth (ft)	Elev. (ft)	Depth/EL to Strata Change (ft)	Stratum	N-Value	No.	Pen. /Rec. (in)	Depth (ft)	Blows Per 6"	Sample Description and Boring Notes
		0.4 / 7.5	TOPSOIL	4	S-1	24/16	0.0-2.0	3 2 2 3	Very loose to loose, mottled gray-brown SILT and SAND, trace gravel. (FILL)
1	7								
2	6								
3	5		FILL						
4	4								
5	3	5.5 / 2.4		4	S-2	6/6	5.0-5.5	2	Very loose, mottled orange-brown and black SILT and SAND, with wood, ash and cinders. (FILL)
6	2		ORGANIC DEPOSIT	4	S-2a	18/18	5.5-7.0	2 2 2	Soft to firm, brown FIBROUS PEAT. (ORGANIC DEPOSIT)
7	1								
8	0	8.0 / -0.1							
9	-1								
10	-2			17	S-3	24/14	10.0-12.0	9 8 9 9	Compact, gray-brown stratified silty SAND to SAND, trace silt. (ALLUVIUM DEOSIT)
11	-3								
12	-4								
13	-5								
14	-6		ALLUVIUM DEPOSIT						
15	-7			18	S-4	24/16	15.0-17.0	8 8 10 9	Compact, stratified gray silty SAND to SAND, trace silt. (ALLUVIUM DEPOSIT)
16	-8								
17	-9								
18	-10								
19	-11								
20	-12	20.0 / -12.1	MARINE CLAY	5	S-5	12/12	20.0-21.0	3 2	Very soft to soft, gray silty CLAY with silt and sand seams. (MARINE CLAY)
21	-13	21.0 / -13.1	MARINE SAND	22	S-5a	12/12	21.0-22.0	8 14	Compact, gray stratified silty SAND to SAND, trace silt. (MARINE SAND)
22	-14								

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
1. Used Automatic Hammer for SPT.
2. Drillers switched to casing after obtaining sample from 10-12'.

Weather: Variable

McPHAIL ASSOCIATES, LLC
42 3rd AVENUE
Burlington, MA 01803
TEL: 617-868-1420
FAX: 617-868-1423

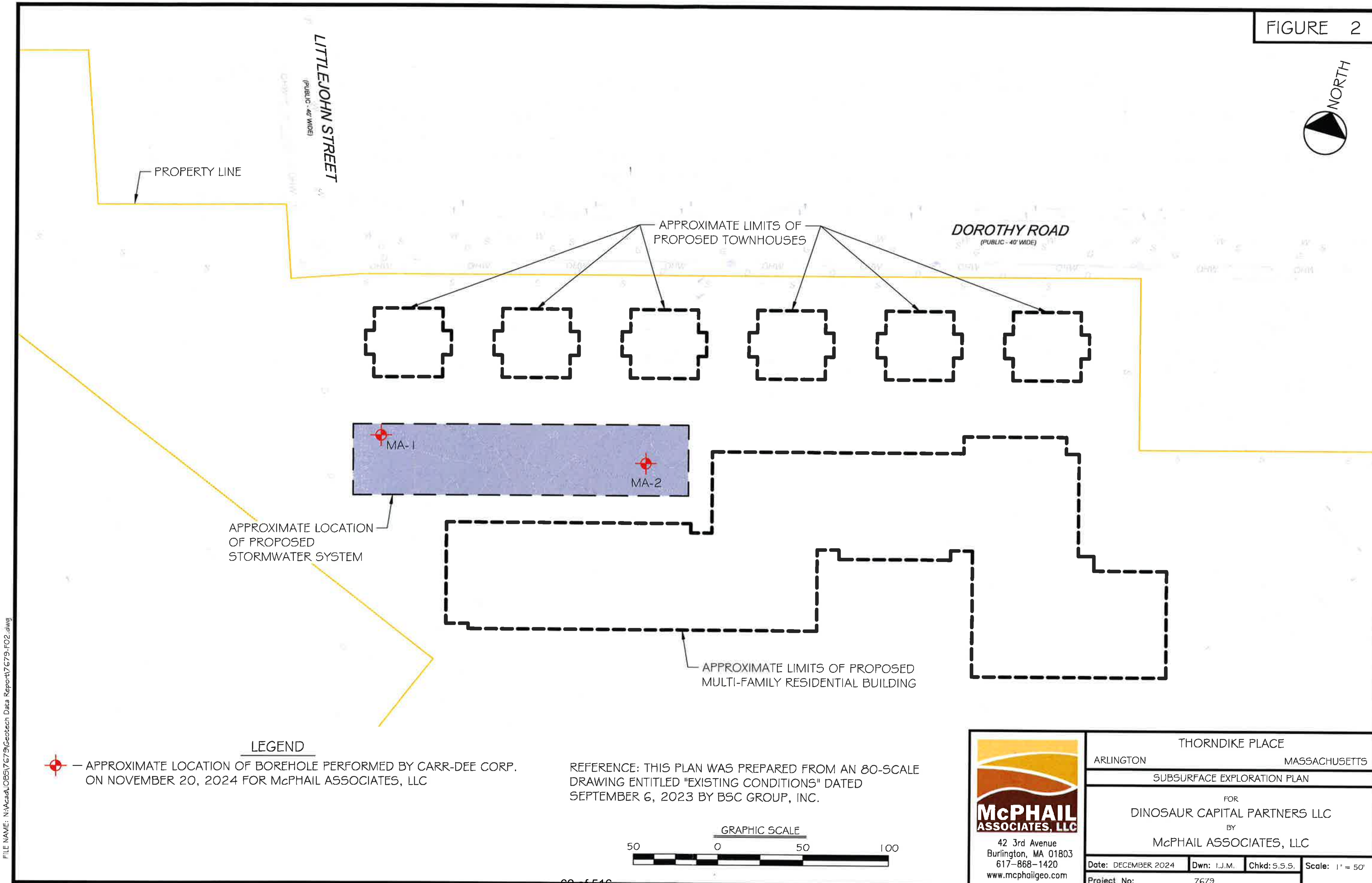
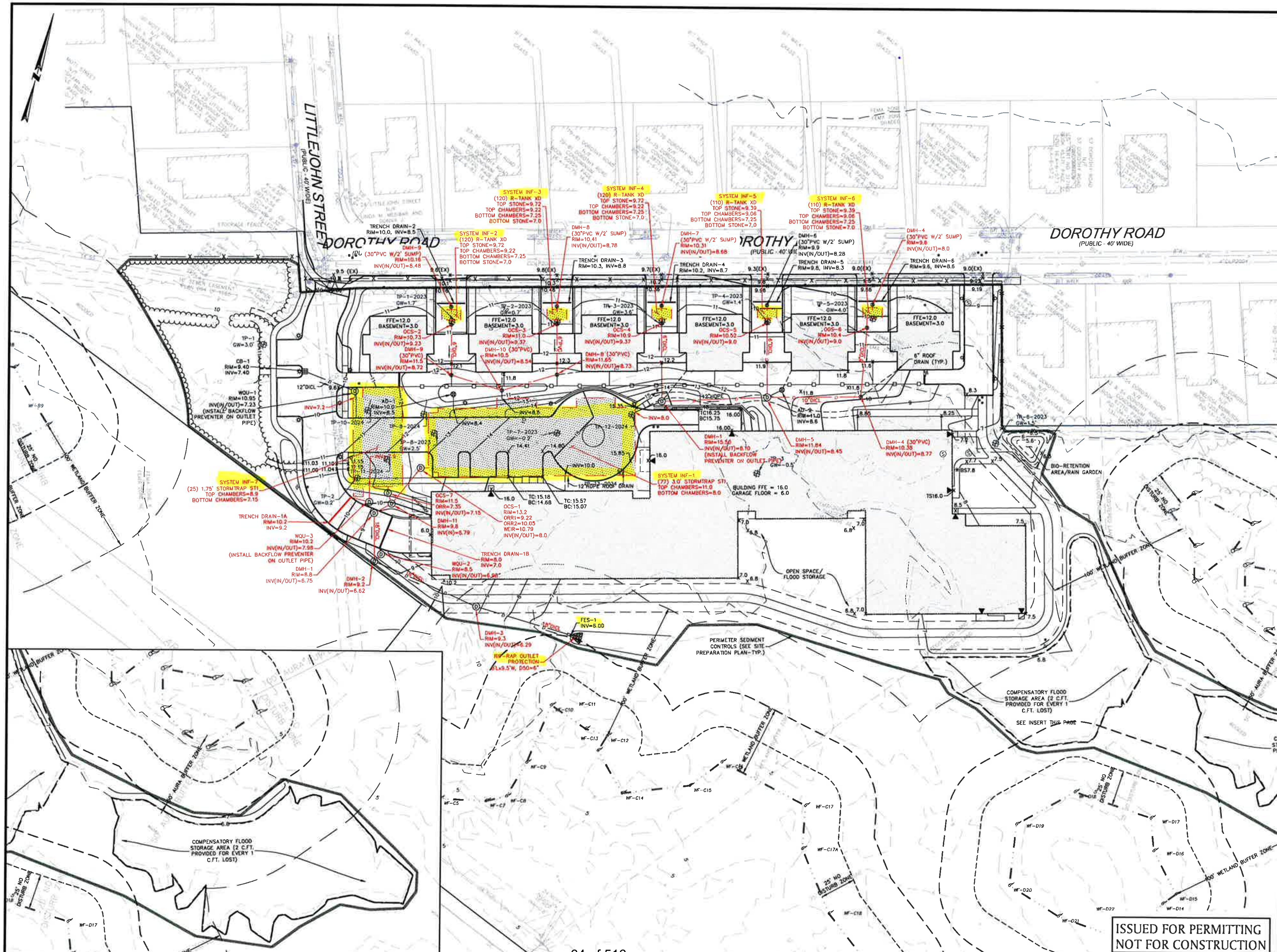


FIGURE 2
NORTH
LITTLEJOHN STREET
(PUBLIC - 40' WIDE)
PROPERTY LINE
APPROXIMATE LIMITS OF PROPOSED TOWNHOUSES
DOROTHY ROAD
(PUBLIC - 40' WIDE)
MA-1
MA-2
APPROXIMATE LOCATION OF PROPOSED STORMWATER SYSTEM
APPROXIMATE LIMITS OF PROPOSED MULTI-FAMILY RESIDENTIAL BUILDING
LEGEND
— APPROXIMATE LOCATION OF BOREHOLE PERFORMED BY CARR-DEE CORP. ON NOVEMBER 20, 2024 FOR McPHAIL ASSOCIATES, LLC
REFERENCE: THIS PLAN WAS PREPARED FROM AN 80-SCALE DRAWING ENTITLED "EXISTING CONDITIONS" DATED SEPTEMBER 6, 2023 BY BSC GROUP, INC.
GRAPHIC SCALE
50
0
50
100
McPHAIL ASSOCIATES, LLC
42 3rd Avenue
Burlington, MA 01803
617-868-1420
www.mcphailgeo.com
THORNDIKE PLACE
ARLINGTON
MASSACHUSETTS
SUBSURFACE EXPLORATION PLAN
FOR
DINOSAUR CAPITAL PARTNERS LLC
BY
McPHAIL ASSOCIATES, LLC
Date: DECEMBER 2024
Dwn: I.J.M.
Chkd: S.S.S.
Scale: 1" = 50'
Project No: 7679
FILE NAME: N:\Acad\JOBS\7679\Geotech Data Report\7679-F02.dwg

ATTACHMENT C

Site Location Plan



ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

PROFESSIONAL ENGINEER

THORNDIKE PLACE
NOTICE OF INTENT

DOROTHY ROAD
IN
ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

GRADING &
DRAINAGE PLAN

SEPTEMBER 6, 2023

REVISIONS:

NO.	DATE	DESC.
1	9/12/24	INFILTRATION SYSTEM
2	12/10/24	PEER REVIEW REVISIONS

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: 1" = 30'
0 15 30 60 FEET

FILE: 2340702\C\D\2340702-GR
DWG.:
JOB. NO: 23407.02
SHEET C-104

ATTACHMENT D

GZA Groundwater Mound Calculations

Groundwater Mound Estimate for Infiltration System -7

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Input Values

0.5400	***R***	**Recharge (infiltration) rate (feet/day)**
0.080	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
5.40	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
17.200	**x**	**1/2 length of basin (x direction, in feet)**
35.200	**y**	**1/2 width of basin (y direction, in feet)**
1.230	**t**	**duration of infiltration period (days)**
16.000	**hi(0)**	**initial thickness of saturated zone (feet)**
18.620	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
2.620	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

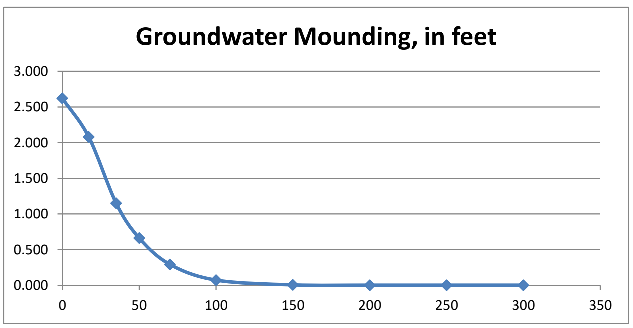
Conversion Table

inch/hour	**feet/day**
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
2.620	**0**
2.078	**17.2**
1.151	**35**
0.662	**50**
0.293	**70**
0.073	**100**
0.007	**150**
0.003	**200**
0.003	**250**
0.003	**300**

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

Groundwater Mound Estimate for Inf-2 to Inf-6

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
0.5400	***R***	**Recharge (infiltration) rate (feet/day)**
0.080	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
5.40	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
6.900	**x**	**1/2 length of basin (x direction, in feet)**
3.600	**y**	**1/2 width of basin (y direction, in feet)**
2.950	**t**	**duration of infiltration period (days)**
16.000	**hi(0)**	**initial thickness of saturated zone (feet)**
16.308	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.308	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

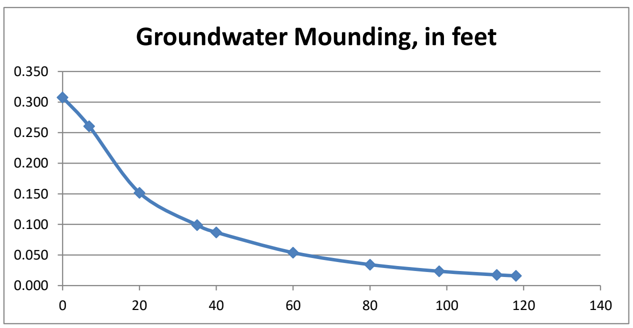
Conversion Table

inch/hour	**feet/day**
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
0.308	**0**
0.261	**6.9**
0.152	**20**
0.099	**35**
0.087	**40**
0.054	**60**
0.034	**80**
0.023	**98**
0.018	**113**
0.016	**118**

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

BSC GROUP
BUILD | SUPPORT | CONNECT

Engineers
Environmental Scientists
Software Developers
Landscape Architects
Planners
Surveyors

www.bscgroup.com

JANUARY 3, 2025

Town of Arlington Conservation Commission
c/o Mr. David Morgan, Environmental Planner + Conservation Agent
Robbins Memorial Town Hall
730 Massachusetts Avenue
Arlington, Massachusetts 02476

RE: Revisions to Stormwater Management/Response to Peer Review
Thorndike Place Residential Development

Dear Members of the Arlington Conservation Commission,

On behalf of the Applicant, Arlington Land Realty, LLC, BSC Group, Inc. (BSC) is pleased to submit this supplemental response to peer review comments provided by GZA GeoEnvironmental, Inc. (GZA) relative to the Thorndike Place residential development (the Project) to be located off of Dorothy Road in the Town of Arlington. On August 1, 2024, GZA submitted written peer review comments (referenced as "Peer Review of Stormwater Mound Evaluation and Design Groundwater Elevation Proposed Thorndike Place Residential Development.") On October 4, 2024, BSC provided its initial response to the GZA peer review comments. Thereafter, at the October 24, 2024 public hearing on the Project, GZA requested that the groundwater mounding analysis for the primary underground infiltration system be performed based on the total volume of water infiltrated during the 100-year, 24-hour storm event. While BSC stands by our previous statement that the stormwater management system as previously submitted meets the requirements of the DEP's Stormwater Standards (the "Standards") as detailed within the Massachusetts Wetlands Protection Act (WPA) regulations, at 310 CMR 10.00, we have made the revisions detailed below to the infiltration system design to address GZA's request while maintaining compliance with the Standards. The revisions to infiltration systems detailed below have been made to accomplish the following while addressing comments made pertaining to groundwater mounding and drawdown in these systems:

1. The use of multiple infiltration systems more closely mimics existing groundwater recharge by providing infiltration throughout the Project site.
2. The systems were designed to reduce the overall volume of infiltration during a 100-year storm event to limit the potential impacts of groundwater mounding during this extreme storm.
3. Each infiltration system is designed to maximize the separation to Estimated Seasonal High Groundwater ("ESHGW").
4. The use of multiple infiltration systems throughout the site allowed the Project to eliminate the previously proposed rooftop detention system.

A complete set of revised Site Plans and revised Stormwater Report are attached to this letter. Additionally, to help simplify review, we are attaching a summary of just the revised calculations and a revised Grading & Drainage Plan (C-104) with the revised stormwater management system notated in red. The following specific revisions have been made to the stormwater management system design to respond to GZA's request while maintaining compliance with the Standards.

1. A revised version of the smaller underground infiltration systems in the townhouse driveways has been incorporated into the design. These systems had been removed in the last iteration of design as shown in BSC's filings of October 4, 2024. Each of the townhouse driveway systems (shown on the attached

803 Summer Street, Third Floor / Boston, MA 02127 / 617-896-4300

Sheet C-104 as Infiltration Systems 2-6) consists of varying numbers of R-Tank XD units with the same footprint and a bottom of stone elevation of 7.0 (i.e., 3-feet above estimated seasonal high groundwater), and designed so they maintain a minimum of 10-feet separation from any building foundation. In larger storm events, these systems will overflow to a larger underground infiltration system (Infiltration System 1). A groundwater mounding analysis of these systems has been performed utilizing the total volume infiltrated during the 100-year, 24-hour storm event resulting in an expected groundwater mound of less than 1-foot. A drawdown analysis utilizing the full volume below the lowest outlet and the Rawls Rate for silt loam per GZA's request (0.27 in/hr) has been performed demonstrating that these systems will drain in less than the required 72-hours. The mounding analysis and drawdown calculations are included in Section 6 of the attached Stormwater Report and Summary of Revised Calculations.

2. With respect to the larger, primary infiltration system, the StormTrap underground chamber system has been modified into two (2) separate underground infiltration systems (shown on the attached plans as Infiltration System 1 and Infiltration System 7) that collect and infiltrate runoff from different areas of the site, as described below.

    a. Infiltration System 1 consists of 77 3.0-foot StormTrap chambers with a bottom elevation of8.0. Overflow from the R-Tank infiltration systems in the townhouse driveways, area drains behind the townhouses, and the roof of the multi-unit building are routed through this system. This system maintains a separation from ESHGW of 4.0-feet, and therefore a groundwater mounding analysis is not required per DEP's Massachusetts Stormwater Handbook. A drawdown analysis using the full volume below the lowest system outlet and the Rawls rate for silt loam demonstrates that the system will drain in less than the required 72-hours (see Section 6 of the attached Stormwater Report and Summary of Revised Calculations).

    b. A separate underground infiltration system, Infiltration System 7 (see attached Sheet C-104), has been located to the west of Infiltration System 1 and consists of 25 1.75-foot StormTrap chambers with a bottom elevation of 7.15 (which corresponds to 3.15-feet above ESHGW). This system collects runoff from driveway and paved areas associated with the multi-unit building. A groundwater mounding analysis of this system has been performed utilizing the total volume infiltrated during the 100-year, 24-hour storm event resulting in an expected groundwater mound of less than 3 feet. A drawdown analysis utilizing the full volume below the lowest outlet and the Rawls Rate for silt loam has been performed demonstrating that this system will drain in less than the required 72-hours (see Section 6 of the attached Stormwater Report and Summary of Revised Calculations). As part of this design, an additional trench drain has been added to the driveway entrance to the multi-unit building to collect runoff and route it into Infiltration System 7 after passing through a water quality unit.

    c. During larger storm events, both Infiltration Systems 1 and 7 overflow to a flared end section (FES-1) to the south of the multi-family building via outlet control structures that connect to a new drain manhole. This is the same discharge point as in the previous designs (see attached Sheet C-104). Please note that the two systems are not connected to each other, but overflow to the same point.

3. The original trench drain in the entrance to the multi-unit building is no longer routed to an underground infiltration system. Stormwater collected in this trench drain, after passing through a water quality unit, will be routed to the same overflow point as Infiltration Systems 1 and 7 (see attached Sheet C-104). Required recharge and TSS removal calculations have been updated to reflect this revision and continue to demonstrate compliance with Stormwater Standards 3 and 4, respectively.

4. The rooftop detention system, or "blue roof," that was previously shown on a portion of the multi-unit building roof has been eliminated from the design. Additionally, the outlet that previously discharged the remaining portion of roof runoff to a flared end section within the open space area of the building

has been eliminated as well, and all roof runoff from this building is routed via roof drains to Infiltration System 1 (see attached Sheet C-104).

5. On November 20, 2024, McPhail Associates, LLC (McPhail) performed two (2) soil borings on the Project site in the areas of proposed Infiltration Systems 1 and 7. These soil borings were performed to better understand the depth to a restrictive layer to more accurately determine the initial saturated thickness to be used in groundwater mounding analyses for the Project. All previous groundwater mounding analyses were performed using an initial saturated thickness of 5-feet, which represented the maximum depth of test pits performed below ESHGW. These borings, included in the attached McPhail memorandum (included as Appendix G of the attached Stormwater Report and Summary of Revised Calculations), showed a marine clay layer with a highest elevation between -12.1 and -17.4. Based on this additional data, all groundwater mounding analyses have been performed using an initial saturated thickness of 16-feet representing the depth between ESHGW (4.0) and the marine clay layer (-12.1).

As previously stated, the plan and stormwater management system revisions described above have been incorporated into the Site Plan Set and Stormwater Report, which are both attached in addition to the Summary of Revised Calculations. As previously stated during the Commission's public hearings on the Project, BSC believes that this design continues to demonstrate full compliance with all the Stormwater Standards of the Wetlands Protection Act and fully responds to all comments and questions received from GZA as the peer reviewer. We look forward to discussing this matter further as the public hearing process moves forward. Please feel free to contact me at (617) 896-4386 or drinaldi@bscgroup.com should you have any questions on the information attached.

Sincerely,
BSC GROUP, INC.

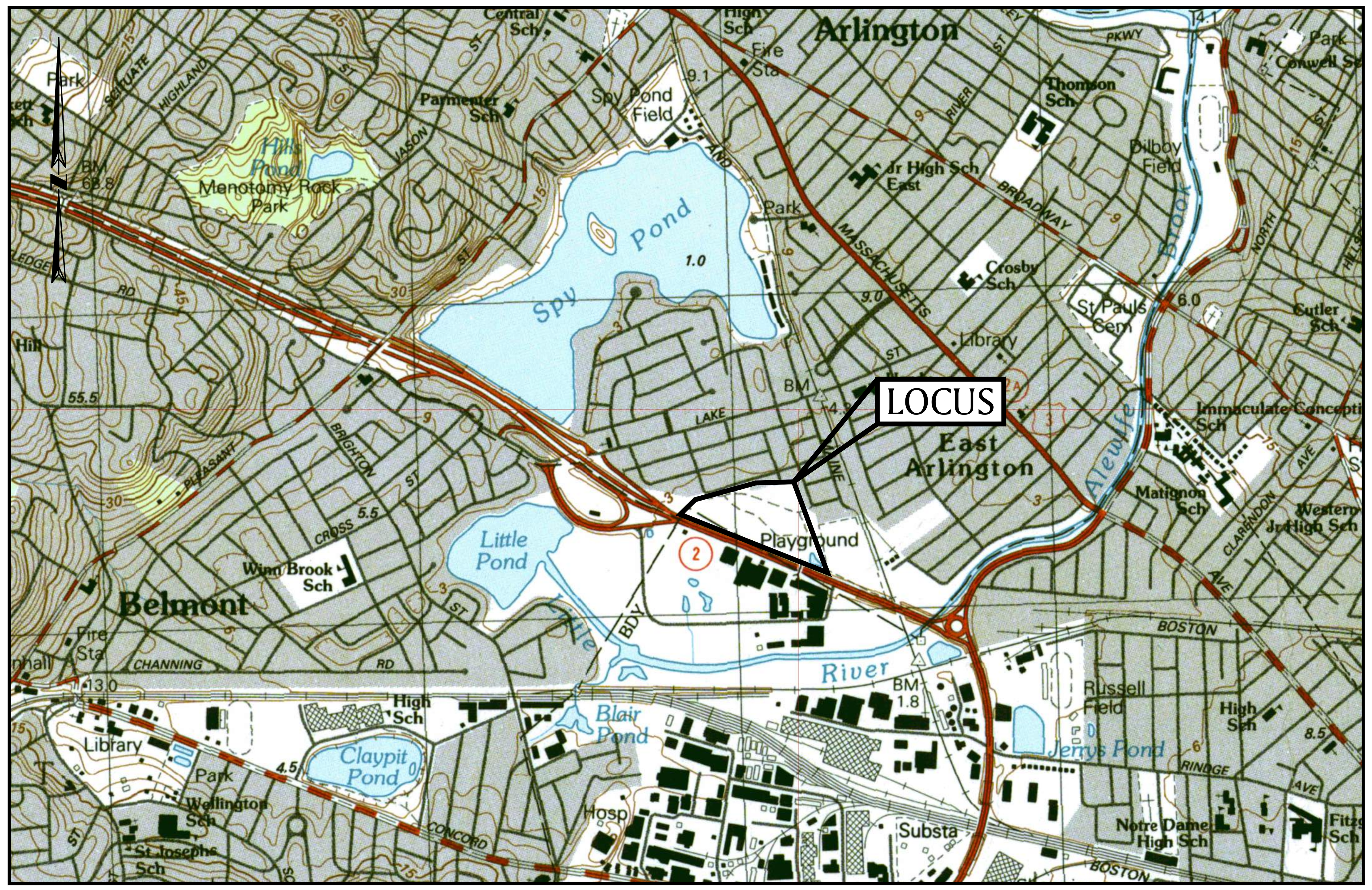
Dominic Rinaldi, PE
Senior Associate

Attachments: Revised Thorndike Place Notice of Intent Site Plan Set (December 10, 2024)
Revised Stormwater Report (December 2024)
Revisions to Stormwater Management Design (December 2024)

THORNDIKE PLACE
NOTICE OF INTENT
DOROTHY ROAD
ARLINGTON, MASSACHUSETTS

SEPTEMBER 6, 2023

REVISED: DECEMBER 10, 2024



LOCUS MAP

500 0 1000 2000 3000 feet

SCALE: 1" = 1000±

INDEX OF DRAWINGS

PREPARED FOR:

ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA 02140

PREPARED BY:

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

JOB NO: 23407.02 DWG NO: G-100

GENERAL NOTES

1. EXISTING CONDITIONS SURVEY INFORMATION WAS PREPARED BY BSC GROUP, INC. SURVEY IS BASED ON AN ON–THE–GROUND SURVEY CONDUCTED BY BSC GROUP IN DECEMBER 2019–FEBRUARY 2020.
2. REVIEW ALL EXISTING CONDITIONS IN THE FIELD AND REPORT ANY DISCREPANCIES BETWEEN PLANS AND ACTUAL CONDITIONS TO THE OWNER'S REPRESENTATIVE IN WRITING PRIOR TO STARTING WORK.
3. THE LOCATIONS OF UNDERGROUND UTILITIES SHOWN ON THIS PLAN ARE BASED ON THE SURVEY REFERENCED ABOVE. THE CONTRACTOR SHALL CONTACT DIGSAFE (888–344–7233 OR 811) AND THE PROPER LOCAL AUTHORITIES OR RESPECTIVE UTILITY COMPANIES TO CONFIRM THE LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. ANY DAMAGE DUE TO FAILURE OF THE CONTRACTOR TO CONTACT THE PROPER AUTHORITIES SHALL BE BORNE BY THE CONTRACTOR.
4. ANY DISCREPANCIES BETWEEN DRAWINGS, SPECIFICATIONS, AND SITE CONDITIONS SHALL BE REPORTED IMMEDIATELY TO THE ENGINEER IN WRITING FOR CLARIFICATION AND RESOLUTION PRIOR TO BIDDING OR CONSTRUCTION.

SITE PREPARATION NOTES

1. ONLY AREAS DESIGNATED FOR CLEARING SHALL BE CLEARED.
2. THE SUBCONTRACTOR(S) IS/ARE RESPONSIBLE FOR ANY DAMAGE TO EXISTING CONDITIONS TO REMAIN THAT ARE DUE TO SUBCONTRACTOR(S) OPERATIONS.
3. ITEMS TO BE REMOVED THAT ARE NOT STOCKPILED FOR LATER REUSE ON THE PROJECT OR DELIVERED TO THE OWNER SHALL BE LEGALLY DISPOSED OF OFF SITE BY THE SUBCONTRACTOR(S).
4. THE SUBCONTRACTOR(S) SHALL BE RESPONSIBLE FOR COORDINATING THEIR EFFORTS WITH ALL TRADES.
5. THE CONTRACTOR SHALL COORDINATE ALL ADJUSTMENT OR ABANDONMENT OF UTILITIES WITH THE RESPECTIVE UTILITY COMPANY.
6. THE SUBCONTRACTOR(S) SHALL MAINTAIN OR ADJUST TO NEW FINISH GRADE AS NECESSARY ALL UTILITY AND SITE STRUCTURES SUCH AS LIGHT POLES, SIGN POLES, MAN HOLES, CATCH BASINS, HAND HOLES, WATER AND GAS GATES, HYDRANTS, ETC., FROM MAINTAINED UTILITY AND SITE SYSTEMS UNLESS OTHERWISE NOTED OR DIRECTED BY THE CONTRACTOR/ENGINEER.
7. TEMPORARY CONSTRUCTION HAUL ROADS (IF REQUIRED) SHALL BE EXCAVATED AND THE SUB–BASE COMPACTED TO 95% SPMDD. THE USE OF SEPARATION FABRICS MAY BE USED TO FACILITATE FUTURE REMOVAL AND RECOVERY OF GRANULAR MATERIALS. HAUL ROAD SHALL HAVE AT LEAST 9" OF 6–INCH MINUS STONE AND SHALL BE MAINTAINED DURING CONSTRUCTION.

EROSION AND SEDIMENT CONTROL MEASURES

1. EROSION CONTROL SHALL BE PROVIDED IN ACCORDANCE WITH THE SEQUENCE OF STAGED CONSTRUCTION. THE CONTRACTOR SHALL SUBMIT A DETAILED EROSION CONTROL PLAN INCLUDING SCHEDULE FOR APPROVAL BY THE TOWN OF ARLINGTON. A COPY OF THE APPROVED NPDES – EROSION AND SEDIMENT CONTROL PLAN SHALL BE MAINTAINED ON THE SITE.
2. ALL EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE INSTALLED PRIOR TO ANY SITE EXCAVATION OR DISTURBANCE AND SHALL BE MAINTAINED THROUGHOUT THE CONSTRUCTION PROCESS. THE SMALLEST PRACTICAL AREA OF LAND SHALL BE EXPOSED AT ANY ONE TIME.
3. SEDIMENT TRAPS SHALL BE INSTALLED AT DRAINAGE STRUCTURES IN PUBLIC STREET IN THE PROJECT AREA. STRAW BALE BARRIERS AND SILTATION FENCES ARE TO BE MAINTAINED AND CLEANED UNTIL ALL SLOPES HAVE BEEN STABILIZED.
4. SEDIMENT BARRIERS SHALL BE INSPECTED AND APPROVED BY THE TOWN OF ARLINGTON BEFORE CONSTRUCTION CAN START.
5. STRAW BALES AND MULCH SHALL BE MOWINGS OF ACCEPTABLE HERBACEOUS GROWTH, FREE OF NOXIOUS WEEDS OR WOODY STEMS, AND SHALL BE DRY WHEN INSTALLED.
6. THE UNDERSIDE OF STRAW BALES SHOULD BE KEPT IN CLOSE CONTACT (TRENCHED IN 3–INCHES MINIMUM) WITH THE EARTH AND RESET AS NECESSARY.
7. DISTURBED AREAS SHALL BE BLANKETED OR SEEDED AND MULCHED AS SOON AS PRACTICAL AFTER CONSTRUCTION ACTIVITIES IN THAT AREA HAVE CONCLUDED. ALL ERODABLE/BARE AREAS SHALL BE BLANKETED OR SEEDED AND MULCHED WITHIN 7 DAYS WITH TEMPORARY EROSION CONTROL SEEDING.
8. STABILIZE SLOPES GREATER THAN 3:1 (HORIZONTAL:VERTICAL) WITH SEED, SECURED GEOTEXTILE FABRIC, SPRAYED COMPOST BLANKET, OR RIP–RAP AS REQUIRED TO PREVENT EROSION DURING CONSTRUCTION.
9. SEDIMENT BARRIERS SHALL BE CONSTRUCTED AROUND ALL SOIL STOCKPILE AREAS.
10. CLEAN OUT DRAINAGE FEATURES AND STRUCTURES AFTER COMPLETION OF CONSTRUCTION.
11. SEDIMENT COLLECTED DURING CONSTRUCTION BY THE VARIOUS TEMPORARY EROSION CONTROL SYSTEMS SHALL BE DISPOSED OF OFF SITE ON A REGULAR BASIS. SEDIMENT SHALL BE REMOVED FROM EROSION CONTROL SYSTEMS WHEN THE HEIGHT OF THE SEDIMENT EXCEEDS ONE–HALF OF THE HEIGHT OF THE SEDIMENT CONTROL MEASURE.
12. AFTER ALL DISTURBED AREAS HAVE BEEN STABILIZED, THE SUBCONTRACTOR(S) SHALL REMOVE ALL TEMPORARY EROSION CONTROL MEASURES AT THE CONTRACTOR/ENGINEER DIRECTION.
13. AFTER THE REMOVAL OF TEMPORARY EROSION CONTROL MEASURES, THE SUBCONTRACTOR(S) SHALL GRADE AND SEED AREA OF TEMPORARY EROSION CONTROL MEASURE.
14. DAMAGED OR DETERIORATED ITEMS WILL BE REPAIRED IMMEDIATELY AFTER IDENTIFICATION OR AS DIRECTED BY THE CONTRACTOR/ENGINEER.
15. THE CONTRACTOR'S SITE SUPERINTENDENT WILL BE RESPONSIBLE FOR DAILY INSPECTIONS, MAINTENANCE, AND REPAIR ACTIVITIES. THE CONTRACTOR SHALL INSPECT EROSION CONTROL MEASURES EVERY SEVEN (7) CALENDAR DAYS. DAMAGED AND INEFFECTIVE EROSION CONTROL MEASURES SHALL BE REPAIRED OR REPLACED WITHIN 48 HOURS.
16. PIPE OUTLETS (IF ANY) SHALL BE STABILIZED WITH STONE.
17. TEMPORARY SEEDING SHALL BE AT A RATE OF 45 LBS PER ACRE. ERODABLE AREAS OUTSIDE AND DOWN SLOPE FROM THE CONSTRUCTION LIMITS SHALL BE SIMILARLY SEEDED.
18. WATER PUMPED OR OTHERWISE DISCHARGED FROM THE SITE DURING CONSTRUCTION DEWATERING SHALL BE FILTERED. DEWATERING PLAN SHALL BE SUBMITTED FOR APPROVAL BY THE ENGINEER.
19. WHEN TEMPORARY DRAINAGE IS ESTABLISHED, EROSION/SEDIMENTATION CONTROL MEASURES MAY BE REQUIRED BY CONTRACTOR/ENGINEER.
20. GRAVEL CONSTRUCTION ROADS AND CONSTRUCTION PARKING AREAS OF SUFFICIENT WIDTH AND LENGTH, AND VEHICLE WASH DOWN FACILITIES, SHALL BE PROVIDED TO PREVENT SOIL FROM BEING TRACKED ONTO PUBLIC OR PRIVATE ROADWAYS. ANY SOIL REACHING A PUBLIC OR PRIVATE ROADWAY SHALL BE REMOVED BEFORE THE END OF EACH WORKDAY AND AS NEEDED.
21. NECESSARY MEASURES SHALL BE TAKEN TO CONTAIN ANY FUEL OR POLLUTION RUNOFF. LEAKING EQUIPMENT OR SUPPLIES SHALL BE IMMEDIATELY REPAIRED OR REMOVED FROM THE SITE.
22. THE COST OF REPAIRING OR REMOVING SEDIMENT FROM EROSION CONTROL SYSTEMS SHALL BE INCLUDED IN THE CONTRACT UNIT PRICE FOR THE APPLICABLE EROSION CONTROL ITEM.
23. ALL EROSION CONTROL MEASURES SHALL BE KEPT OPERATIONAL AND MAINTAINED CONTINUOUSLY THROUGHOUT THE PERIOD OF LAND DISTURBANCE UNTIL PERMANENT SEDIMENT AND EROSION CONTROL MEASURES ARE OPERATIONAL. CONTRACTOR SHALL PROVIDE TO THE CONSERVATION COMMISSION MEASURES (EROSION AND SEDIMENTAITON CONTROL) FOR WORK DURING WINTER CONDITIONS.
24. CONTRACTOR SHALL SPRAY WATER FROM A WATER TRUCK ON DRY AND WINDY DAYS TO PREVENT DUST FROM FORMING.
25. EROSION CONTROL MEASURES AS SHOWN ON THESE DRAWINGS ARE INTENDED TO CONVEY MINIMUM REQUIREMENTS. THE CONTRACTOR SHALL IMPLEMENT ADDITIONAL MEASURES AS NECESSARY TO PREVENT SOIL EROSION AND TO COMPLY WITH THE PROJECT'S STORMWATER POLLUTION PREVENTION PLAN.
26. SOILS ON SLOPES THAT ARE 3:1 OR STEEPER SHOULD BE ROUGHENED PER THE EPA'S NPDES SOIL ROUGHENING FACT SHEET IF THEY ARE TO BE SEEDED WITHIN 2 WEEKS OF DISTURBANCE. IF NOT, EROSION CONTROL BLANKETS SHOULD BE INSTALLED ON THESE SLOPES.

LAYOUT AND MATERIAL NOTES

1. THE FOLLOWING LAYOUT CRITERIA SHALL CONTROL UNLESS OTHERWISE NOTED ON THE PLAN:
   a. ALL TIES TO PROPERTY LINES ARE PERPENDICULAR TO THE PROPERTY LINE UNLESS OTHERWISE NOTED.
   b. DISTANCES AND DIMENSIONS ARE IN DECIMAL FEET.
2. SCREENED IMAGES SHOW EXISTING CONDITIONS. WHERE EXISTING CONDITIONS LIE UNDER OR ARE IMPINGED UPON BY PROPOSED BUILDINGS AND/OR SITE ELEMENTS, THE EXISTING CONDITION SHALL BE REMOVED, ABANDONED AND/OR CAPPED OR DEMOLISHED AS REQUIRED. AMBIGUITIES IN THE PLANS SHALL BE CLARIFIED BY THE ENGINEER OR SITE SUPERINTENDENT UPON WRITTEN REQUEST FOR CLARIFICATION BY THE SUBCONTRACTOR.

GRADING AND UTILITY NOTES

1. THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE APPLICANT. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MAY BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ALL UNDERGROUND UTILITIES.
2. THE PROJECT APPLICANT SHALL OBTAIN ALL NECESSARY STREET–OPENING PERMITS, WATER AND SEWER CONNECTION PERMITS AND PAY REQUIRED FEES PRIOR TO COMMENCING WORK ON THESE UTILITIES.
3. WHERE AN EXISTING UTILITY IS FOUND TO CONFLICT WITH THE PROPOSED WORK, THE LOCATION, ELEVATION, AND SIZE OF THE UTILITY SHALL BE ACCURATELY DETERMINED WITHOUT DELAY BY COORDINATION WITH THE TOWN OF ARLINGTON.
4. ALL ARRANGEMENTS FOR THE ALTERATION AND ADJUSTMENT OF ALL GAS, ELECTRIC, TELEPHONE, AND ANY OTHER PRIVATE UTILITIES BY THE UTILITY COMPANIES SHALL BE MADE BY THE PROJECT APPLICANT.
5. AREAS OUTSIDE THE LIMITS OF PROPOSED WORK DISTURBED BY THE CONSTRUCTION SHALL BE RESTORED TO THEIR ORIGINAL CONDITION.
6. WHERE PROPOSED GRADES MEET EXISTING GRADES, SUBCONTRACTOR(S) SHALL BLEND GRADES TO PROVIDE A SMOOTH TRANSITION BETWEEN EXISTING AND NEW WORK. PONDING AT TRANSITION AREAS WILL NOT BE ALLOWED.
7. POSITIVE DRAINAGE SHALL BE MAINTAINED AWAY FROM ALL STRUCTURES.
8. SUBCONTRACTOR(S) SHALL VERIFY EXISTING GRADES AND NOTIFY THE ENGINEER IN WRITING OF ANY DISCREPANCIES.
9. PRIOR TO ANY WORK OVER EXISTING TOWN–OWNED UTILITIES, CONTRACTOR TO EVALUATE CONDITION OF SUBSURFACE UTILITIES PRIOR TO CONSTRUCTION. A POST–CONSTRUCTION EVALUATION SHALL ALSO BE PERFORMED TO IDENTIFY ANY DAMAGE CAUSED DURING CONSTRUCTION.
10. ANY INSTALLATION OF UTILITY POLES OR UNDERGROUND CONDUIT WITHIN THE PUBLIC RIGHT–OF–WAY WILL REQUIRE A GRANT OF LOCATION FROM THE BOARD OF SELECTMEN.

PLANTING NOTES

1. MAINTENANCE SHALL BEGIN IMMEDIATELY AFTER PLANTING AND SHALL CONTINUE UNTIL FINAL WRITTEN ACCEPTANCE OF PLANT MATERIAL.
2. MAINTAIN POSITIVE DRAINAGE AWAY FROM ALL BUILDING FOUNDATIONS AND STRUCTURES.
3. MAXIMUM SLOPE WITHIN DISTURBED AREAS SHALL NOT EXCEED 3:1, UNLESS OTHERWISE NOTED.
4. THE LANDSCAPE CONTRACTOR SHALL SUPPLY ALL PLANT MATERIALS IN QUANTITIES SUFFICIENT TO COMPLETE PLANTINGS SHOWN ON THE DRAWINGS.
5. MATERIALS SHALL CONFORM TO THE GUIDELINES ESTABLISHED BY THE AMERICAN NURSERY AND LANDSCAPE ASSOCIATION.
6. PLANTS SHALL BEAR THE SAME RELATIONSHIP TO FINISH GRADE AS TO ORIGINAL GRADES BEFORE DIGGING.
7. PLANTS SHALL BE BALLED IN BURLAP OR CONTAINERIZED.
8. AREAS PLANTED WITH EVERGREEN TREES SHALL BE COVERED WITH A MINIMUM 3" OF MULCH. MULCH FOR PLANTED AREAS TO BE AGED PINE BARK: PARTIALLY DECOMPOSED, DARK BROWN IN COLOR AND FREE OF WOOD CHIPS THICKER THAN 1/4 INCH.
9. THE LANDSCAPE CONTRACTOR SHALL GUARANTEE ALL PLANT MATERIALS FOR ONE (1) FULL YEAR FROM DATE OF ACCEPTANCE.
10. PLANT MATERIALS ARE SUBJECT TO THE APPROVAL OF THE LANDSCAPE ARCHITECT, AT THE NURSERY, AND AT THE SITE.
11. PLANT SPECIES AS INDICATED IN THE PLANT LIST ARE SUGGESTIONS ONLY. FINAL SELECTION OF SPECIES SHALL OCCUR AT THE TIME OF PLANT PURCHASE, DEPENDING ON AVAILABILITY. PLANT SIZE AND QUANTITY SHALL NOT CHANGE WITHOUT APPROVAL OF LANDSCAPE ARCHITECT. ANY CHANGES TO PLANT SPECIES SHALL BE REVIEWED AND APPROVED BY A REPRESENTATIVE OF THE ARLINGTON CONSERVATION COMMISSION PRIOR TO PURCHASE.

COMPREHENSIVE PERMIT NOTES

CONTRACTOR REQUIRED TO ABIDE BY THE 'DECISION ON APPLICATION FOR COMPREHENSIVE PERMIT' ISSUED ON NOVEMBER 22, 2021 WITH SPECIFIC ATTENTION BROUGHT TO THE FOLLOWING CONDITIONS.

D.15 BURNING OR BURIAL OF CONSTRUCTION OR DEMOLITION DEBRIS ON THE SITE IS STRICTLY PROHIBITED. ALL SUCH MATERIALS ARE TO BE REMOVED FROM THE SITE IN ACCORDANCE WITH APPLICABLE LAW. DURING CONSTRUCTION, THE SITE SHALL BE SECURED AGAINST UNAUTHORIZED ENTRY OR VANDALISM BY FENCING, OR OTHER APPROPRIATE MEANS, AND ALL CONSTRUCTION MATERIALS SHALL BE STORED OR STOCKPILED ON SITE IN A SAFE MANNER. ANY FLOODLIGHTS USED DURING THE CONSTRUCTION PERIOD SHALL BE LOCATED AND DIRECTED SO AS TO PREVENT SPILLOVER OR ILLUMINATION ONTO ADJACENT PROPERTIES. ALL CONSTRUCTION ACTIVITIES ARE TO BE CONDUCTED IN A WORKMANLIKE MANNER.

D.16 NO BUILDING AREAS SHALL BE LEFT IN AN OPEN, UNSTABILIZED CONDITION LONGER THAN SIXTY (60) DAYS. TEMPORARY STABILIZATION SHALL BE ACCOMPANIED BY HAY BALES, HAY COVERINGS OR MATTING. FINAL STABILIZATION SHALL BE ACCOMPLISHED BY LOAMING AND SEEDING EXPOSED AREAS.

D.17 ALL DUMPSTERS SERVING THE PROJECT SHALL BE ENCLOSED AND COVERED (WITH THE EXCEPTION OF CONSTRUCTION DUMPSTERS USED DURING CONSTRUCTION). THE BOARD SHALL REVIEW THE DUMPSTER LOCATION AS PART OF THE APPROVAL OF THE FINAL PLANS IF DIFFERENT FROM WHAT HAS BEEN SHOWN ON THE APPROVED PLANS.

H.2 ALL WATER AND SEWER INFRASTRUCTURE SHALL BE INSTALLED IN CONFORMANCE WITH THE ARLINGTON WATER AND SEWER DIVISION'S TECHNICAL REQUIREMENTS. THE APPLICANT SHALL PROVIDE THE ARLINGTON WATER AND SEWER DIVISION WITH CALCULATIONS TO ENSURE THE DISTRIBUTION SYSTEM FOR THE AREA HAS THE NECESSARY CAPACITY TO MEET SYSTEM DEMAND REQUIRED PRIOR TO THE COMMENCEMENT OF CONSTRUCTION.

I.1 PRIOR TO COMMENCEMENT OF SITE CLEARING, PREPARATION, AND CONSTRUCTION, EROSION CONTROL MEASURE SHALL BE INSTALLED CONSISTENT WITH THE APPROVED PLANS.

I.3 NO UNCOVERED STOCKPILING OF EARTHEN AND/OR CONSTRUCTION–RELATED MATERIALS SHALL BE PERMITTED WITHIN THE ONE HUNDRED FOOT (100') WETLAND BUFFER ZONE (ALSO REFERENCED LOCALLY AS ADJACENT UPLAND RESOURCES AREA ("AURA")) OR OTHER RESOURCE AREAS.

I.4 NO HEAVY EQUIPMENT MAY BE STORED OVERNIGHT WITHIN THE FIFTY FEET (50') OF BORDERING OR ISOLATED VEGETATED WETLAND RESOURCE AREAS, AND NO REFUELING OR MAINTENANCE OF MACHINERY OR VEHICLES SHALL BE ALLOWED WITHIN THE ONE HUNDRED FOOT (100') BUFFER ZONE, AURA, OR WITHIN ANY BORDERING OR ISOLATED VEGETATED WETLAND RESOURCE AREA OR BORDERING LAND SUBJECT TO FLOODING (BLSF).

I.5 THERE SHALL BE NO DUMPING OF WOODY VEGETATION, LEAVES, GRASS CLIPPINGS, BRUSH, OR OTHER DEBRIS INTO A WETLAND RESOURCE AREA OR ASSOCIATED BUFFER ZONES. DUMPING OF SNOW INTO A WETLAND RESOURCE AREA IS ALSO PROHIBITED AND SHALL COMPLY WITH THE CURRENT MASS DEP BUREAU OF WATER RESOURCES SNOW REMOVAL GUIDANCE. THE FOREGOING DOES NOT APPLY TO THE CLEAN SNOW REMOVED FROM THE EMERGENCY ACCESS ROAD AS LONG AS NO SAND OR NON–APPROVED DE–ICING MATERIALS ARE USED, AND THE SNOW IS CLEAR OF ALL FOREIGN DEBRIS. AN ALTERNATIVE DE–ICING PRODUCT SUCH AS MAGNESIUM CHLORIDE (MgCl) MAY BE USED AS RECOMMENDED IN THE WINTER PARKING LOT AND SIDEWALK MAINTENANCE MANUEL PUBLISHED BY THE MINNESOTA POLLUTION CONTROL AGENCY, HTTP://WWW.PCA.STATE.MN.US/SITES/DEFAULT/FILES/P–TRL–10/PDF.

I.6 THE APPLICANT SHALL HIRE A QUALIFIED ENVIRONMENTAL MONITOR WHO WILL REPORT TO THE BOARD AND WILL BE ON–SITE AS PROJECT CONSTRUCTION ADVANCES. THE ENVIRONMENTAL MONITOR SHALL SUBMIT AN ELECTRONIC REPORT TO THE BOARD WEEKLY DURING SITE PREPARATION WORK WITHIN THE ONE HUNDRED FOOT (100') BUFFER ZONE TO VEGETATED WETLANDS, INCLUDING AN UPDATE ON THE FUNCTIONALITY AND CONDITION OF THE EROSION CONTROL MEASURES, UNTIL SUCH TIME THAT THE SITE IS STABILIZED. THE APPLICANT SHALL PROVIDE THE BOARD WITH THE NAME(S), ADDRESS(ES) AND TELEPHONE NUMBER(S) OF THE ENVIRONMENTAL MONITOR PRIOR TO THE START OF WORK.

I.7 WHILE ACTIVE CONSTRUCTION WORK IN UNDERWAY WITHIN THE ONE HUNDRED FOOT (100') BUFFER ZONE, AND DURING THE CREATION OF THE FLOODPLAIN COMPENSATION AREA INCLUDING REMOVAL OF VEGETATION INCLUDING INVASIVE SPECIES, FINAL GRADE ESTABLISHMENT, CREATION OF SOIL PROFILE TO SUPPORT PROPOSED PLANT SPECIES, AND RESTORATION OF A DIVERSIFIED PLANT COMMUNITY, THE ENVIRONMENTAL MONITOR SHALL PROVIDE MONTHLY STATUS REPORTS TO THE BOARD TO CONFIRM THAT ALL ACTIVITIES ARE SUBSTANTIALLY IN COMPLIANCE WITH THE COMPREHENSIVE PERMIT AND ORDER OF CONDITIONS ISSUED BY THE ARLINGTON CONSERVATION COMMISSION. THE ZBA MAY REDUCE THE FREQUENCY OF INSPECTIONS OR REPORTS AS DEEMED APPROPRIATE. THE QUALIFIED ENVIRONMENTAL MONITOR SHALL ALSO SUBMIT AN ELECTRONIC REPORT WITHIN SEVEN DAYS AFTER EVERY RAIN EVENT EXCEEDING 0.5 INCHES OF RAIN IN A 24–HOUR PERIOD TO THE BOARD REGARDING THE CONDITION OF THE PROPERTY DURING AND AFTER THE RAIN EVENT. SUCH REPORT SHALL ALSO INCLUDE THE STATUS OF EROSION CONTROL MEASURES AND ANY ADDITIONAL MEASURES TO ADDRESS STORMWATER MANAGEMENT CAUSED BY SAID RAIN EVENT. THE QUALIFIED ENVIRONMENTAL MONITOR WILL ALSO REVIEW THE APPLICANT'S SWPPP INSPECTION REPORT, AS APPROPRIATE AND NECESSARY.

I.8 ALL WORK SHALL BE CONDUCTED IN ACCORDANCE WITH THE APPROVED EROSION AND SEDIMENTATION CONTROL PLAN. WITHIN ONE WEEK OF FINAL GRADING, WEATHER PERMITTING, ALL DISTURBED AREAS LOCATED WITHIN THE WETLAND RESOURCE AREAS AND BUFFER ZONES SHALL BE STABILIZED AGAINST EROSION. THIS SHALL BE DONE EITHER BY SODDING OR BY LOAMING, SEEDING AND MULCHING ACCORDING TO SOIL CONSERVATION SERVICE STANDARDS AND THE APPROVED PLANS. STABILIZATION WILL BE COMPLETED WHEN THE SURFACE SHOWS COMPLETE VEGETATIVE COVER. TEMPORARY STABILIZATION MEASURES APPROVED BY THE BOARD'S INSPECTIONAL ENGINEER WILL BE REQUIRED SHOULD WORK BE INTERRUPTED FOR MORE THAN TEN (10) DAYS.

I.9 THE APPLICANT, SUCCESSOR OR ASSIGNS SHALL ENSURE THE CLEANLINESS OF ALL CATCH BASINS AND ROADWAY AFFECTED BY THE PROJECT RELATED ACTIVITY. ALL CATCH BASINS WILL BE PROTECTED BY A "SILT BAG INLET PROTECTION" DEVICE OR EQUAL DURING THE PROJECT WORK PERIOD. THE APPLICANT SHALL INSPECT AND CLEAN AS NECESSARY, ALL CATCH BASINS AND SWEEP THE ROADWAY AT LEAST WEEKLY DURING CONSTRUCTION. IT MAY BE REQUIRED MORE FREQUENTLY DURING AND AFTER RAIN EVENTS. IF IT IS DEEMED NECESSARY TO REMOVE THE SILT BAG INLET PROTECTION TO PREVENT LOCALIZED FLOODING AND PUBLIC SAFETY CONCERNS, THE APPLICANT SHALL NOTIFY THE BOARD AND ARLINGTON DPW AND ALSO THE QUALIFIED ENVIRONMENTAL MONITOR.

I.11 THE BOARD OR ITS DULY APPOINTED AGENT (WHICH MAY BY THE TOWN CONSERVATION AGENT ACTING ON BEHALF OF THE BOARD) SHALL HAVE THE RIGHT TO ENTER THE PROPERTY FOR INSPECTIONS AND EVALUATE COMPLIANCE WITH THE WETLANDS CONDITIONS CONTAINED HEREIN UPON REASONABLE NOTICE OF NOT LESS THAN TWENTY–FOUR (24) HOURS. ACCESS SHALL BE ALLOWED WITHOUT THE NEED FOR ADVANCED NOTICE IN EMERGENCY SITUATIONS WHEN NECESSARY TO PREVENT IMMINENT HARM TO WETLANDS RESOURCE AREAS.

I.14 PRIOR TO ANY WORK COMMENCING ON–SITE, THE APPLICANT SHALL SUBMIT TO THE BOARD PROOF THAT A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) CONSTRUCTION GENERAL PERMIT IS ACTIVE FOR THE PROJECT.

I.15 COPIES OF ALL INFORMATION AND ALL REQUIRED REPORTS REGARDING A US EPA NPDES PERMIT AND STORMWATER POLLUTION PREVENTION PLAN (SWPPP) SHALL BE FORWARDED TO THE BOARD VIA ELECTRONIC COPY.

I.19 THE APPLICANT SHALL RETAIN A QUALIFIED PROFESSIONAL ENGINEER TO OVERSEE THE INSTALLATION IF THE STORMWATER SYSTEM. A STORMWATER MITIGATION REPORT SHALL BE SUBMITTED TO THE BOARD WITHIN TEN (10) DAYS OF THE COMPLETION OF THE INSTALLATION OF THE STORMWATER MANAGEMENT SYSTEM. SUCH STORMWATER MITIGATION REPORT SHALL INCLUDE AS–BUILT PLANS, PHOTOGRAPHS FROM INSTALLATION, AND A WRITTEN SUMMARY OF THE INSTALLATION OF THE STORMWATER MANAGEMENT SYSTEMS, AS WELL AS STORMWATER BEST MANAGEMENT PRACTICES (POROUS PAVEMENT, RAIN GARDENS, AND SIMILAR ELEMENTS THROUGHOUT THE PROPERTY).

I.20 THE APPLICANT SHELL TREAT PLANTED AREAS WITHIN RESOURCE AREAS AND BUFFER ZONES ONLY WITH SLOW RELEASE NITROGEN FERTILIZER ONCE DURING THE INITIAL PLANTING YEAR. APPLICATION OF THIS FERTILIZER IS NOT PERMITTED WITHIN TWO DAYS BEFORE AND AFTER STORM EVENTS. LAWN FERTILIZER MAY ONLY BE APPLIED TWICE PER YEAR, ONCE IN THE SPRING AND ONCE IN THE FALL, WITH THE EXCEPTION OF THE INITIAL PLANNING YEAR. THIS SHALL BE A CONTINUING CONDITION IN PERPETUITY THAT SURVIVES THE EXPIRATION OF THIS PERMIT.

I.21 THE APPLICATION OF PLANT NUTRIENTS SHALL COMPLY WITH 330 CMR 31.00. NO OTHER HERBICIDES OR TREATMENT METHODS MAY BE UTILIZED ON THE PROPERTY UNLESS APPROVED AS PART OF THE APPROVED INVASIVE SPECIES MANAGEMENT PLAN. NO PESTICIDES OR RODENTICIDES SHALL BE USED TO TREAT PEST MANAGEMENT ISSUES WITHIN RESOURCE AREAS. THIS SHALL BE A CONTINUING CONDITION IN PERPETUITY THAT SURVIVES THE EXPIRATION OF THIS PERMIT.

I.22 EXCEPT AS SPECIFICALLY NOTED IN CONDITION i.5, THE APPLICATION OF SAND AND/OR SALT WITHIN THE ONE HUNDRED FEET (100') OF RESOURCE AREA IS PROHIBITED.

I.23 THE APPLICANT SHALL CONDUCT A THOROUGH CATCH BASIN SUMP CLEANING AT ALL PROTECTED CATCH BASINS AT THE END OF CONSTRUCTION OF THE PROJECT.

I.25 ALL PLANT SPECIES PLANTED AND INVASIVE SPECIES REMOVED THROUGH THE PROJECT SHALL BE MONITORED FOR THREE YEARS. A SURVIVAL RATE OF EIGHTY PERCENT (80%) MUST BE MAINTAINED FOR THE APPROVED PLANTING AT THE END OF THE THIRD YEAR OF MONITORING. IF THE SURVIVAL RATE IS LESS THAN EIGHTY PERCENT (80%) AFTER THE END OF THE THIRD YEAR, THE APPLICANT MUST SUBMIT PROPOSED RECOMMENDATIONS FOR REPLACEMENT TO THE BOARD FOR ITS REVIEW AND ADMINISTRATIVE APPROVAL. A MONITORING REPORT SHALL BE SUBMITTED ANNUALLY IN JUNE FOR EACH OF THE YEARS IN THE THREE–YEAR MONITORING PERIOD, REPORTING ON THE HEALTH OF THE NEW PLANTINGS AND THE SUCCESS OF THE INVASIVE PLANT MANAGEMENT. THE APPLICANT SHALL SUBMIT THE CONTACT INFORMATION OF THE PARTY RESPONSIBLE FOR MONITORING AND MAINTAINING THE PLANTED VEGETATION TO THE ZBA. SHOULD ANY CHANGES BY MADE TO THIS PARTY, THE ZBA SHALL BE NOTIFIED. THIS SHALL BE A CONTINUING CONDITION IN PERPETUITY THAT SURVIVES THE EXPIRATION OF THIS PERMIT.

I.26 NO WORK SHALL BE ALLOWED IN OR WITHIN TWENTY–FIVE FEET (25') OF ANY RESOURCES AREA EXCEPT AS SHOWN ON THE APPROVED PLANS.

I.27 NO DISTURBANCES SHALL BE ALLOWED IN OR WITHIN FIFTY FEET (50') OF ANY RESOURCE AREA, EXCEPT AS SHOWN ON THE APPROVED PLANS.

I.30 ANY BUILDING OR SITE DEWATERING OPERATIONS SHALL CONFORM TO THE FOLLOWING:

1. THE APPLICANT SHALL NOTIFY THE CONSERVATION COMMISSION AND DPW THAT DEWATERING IS REQUIRED PRIOR TO COMMENCING ANY DEWATERING OPERATIONS.

2. ANY CATCH BASINS, DRAINS, AND OUTFALLS TO BE USED IN DEWATERING OPERATIONS SHALL BE CLEANED OUT BEFORE OPERATIONS BEGIN.

3. ANY WATER DISCHARGING AS PART OF ANY DEWATERING OPERATION SHALL BE PASSED THROUGH FILTERS, ON–SITE SETTLING BASINS, SETTLING TANK TRUCKS, OR OTHER DEVICES TO ENSURE THAT NO OBSERVABLE SEDIMENTS OR POLLUTANTS ARE CARRIED INTO ANY RESOURCE AREA, STREET, DRAIN, OR ADJACENT PROPERTY. FILTERING IS ESSENTIAL TO REMOVE ANY AUTOMOTIVE POLLUTANTS FROM THE WATER PRIOR TO DISCHARGE.

4. MEASURES SHALL BETAKEN TO ENSURE NO EROSION OR SCOURING SHALL OCCUR ON PUBLIC OR PRIVATE PROPERTY, OR ON THE BANKS OR BOTTOMS OF WATER BODIES, AS A RESULT OF DEWATERING OPERATIONS. DISCHARGES ARE TO BE SET BACK AT LEAST FIFTY FEET (50') FROM BVW AND IVW.

5. DEWATERING SHALL NOT TAKE PLACE IN ANY MANNER THAT LEADS TO WATER BEING DISCHARGES OR ALLOWED TO FLOW ONTO PROPERTY NOT UNDER THE CONTROL OF THE APPLICANT WITHOUT THE EXPRESS WRITTEN CONSENT OF THAT PROPERTY OWNER.

ABBREVIATIONS

BC	BOTTOM OF CURB
BIT CONC	BITUMINIOUS CONCRETE
BVW	BORDERING VEGETATED WETLANDS
CB	CATCH BASIN
CB/DH	CONC. BOUND/DRILL HOLE
CLF	CHAIN LINK FENCE
DIP	DUCTILE IRON PIPE
DMH	DRAIN MANHOLE
ECB	EROSION CONTROL BARRIER
FES	FLARED END SECTION
FH	FIRE HYDRANT
FOC	FACE OF CURB
FD	FOUND
GG	GAS GATE
HW	HEADWALL
ILSF	ISOLATED LAND SUBJECT TO FLOODING
IP	IRON PIPE
ISW	ISOLATED WETLANDS
LA	LANDSCAPED AREA
LOW	LIMIT OF WORK
N/F	NOW OR FORMERLY
NTS	NOT TO SCALE
OCS	OUTLET CONTROL STRUCTURE
PCC	PRECAST CONCRETE CURB
RW	RETAINING WALL
RCP	REINFORCED CONCRETE PIPE
SLC	STREET LIGHT CIRCUIT
SMH	SEWER MANHOLE
TC	TOP OF CURB
TEL	TELEPHONE CABLE
VGC	VERTICAL GRANITE CURB
WG	WATER GATE

LEGEND

STONE BOUND W/DRILL HOLE
STONE BOUND W/ESCUTCHEON PIN
CONCRETE BOUND
SEWER MANHOLE
DRAIN MANHOLE
WATER MANHOLE
ELECTRIC MANHOLE
TELEPHONE MANHOLE
CABLE MANHOLE
MANHOLE
CATCH BASIN
HYDRANT
WATER GATE
GAS GATE
UTILITY POLE
UTILITY POLE W/LIGHT
UTILITY POLE W/TRANSFORMER
LIGHT POLE
ELECTRIC HANDHOLE
HANDHOLE
SIGN
WETLANDS FLAG

BIT	BITUMINOUS CONCRETE
CONC	CONCRETE
EP	EDGE OF PAVEMENT
GC	GRANITE CURB
WC	WOOD CURB
I= AND INV=	INVERT
(R)	RECORD INFORMATION

SEWER LINE
DRAIN LINE
WATER LINE
GAS LINE
OVERHEAD WIRE
CHAIN LINK FENCE
STOCKADE FENCE
STEEL GUARDRAIL
TREELINE
BRUSHLINE
SURVEYED BUILDING LOCATION
GIS BUILDING LOCATION

WATER VALVE
CB CATCH BASIN
FIRE HYDRANT
TF TREE FILTER
\# OF PARKING SPACES
SEWER MANHOLE
FENCE LINE
PROPERTY LINE
WETLAND LINE/FLAG
100 (E) MAJOR CONTOUR
99 (E) MINOR CONTOUR
100 PROPOSED MAJOR CONTOUR
99 PROPOSED MINOR CONTOUR
100' WETLAND BUFFER ZONE
25' NO DISTURB ZONE
WATER QUALITY UNIT/INLET
WATER QUALITY UNIT

DECIDUOUS TREES

EVERGREEN TREES

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

PROFESSIONAL ENGINEER

THORNDIKE PLACE NOTICE OF INTENT

DOROTHY ROAD
IN
ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

GENERAL NOTES AND LEGEND

SEPTEMBER 6, 2023

REVISIONS:

NO.	DATE	DESC.
1	02/12/24	REV. PLANTING NOTE 11
2	12/10/24	PEER REVIEW REVISIONS

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: NONE
FEET

FILE: 2340702\C\D\2340702–LN
DWG.:
JOB. NO: 23407.02
SHEET G–101

PLAN REFERENCES

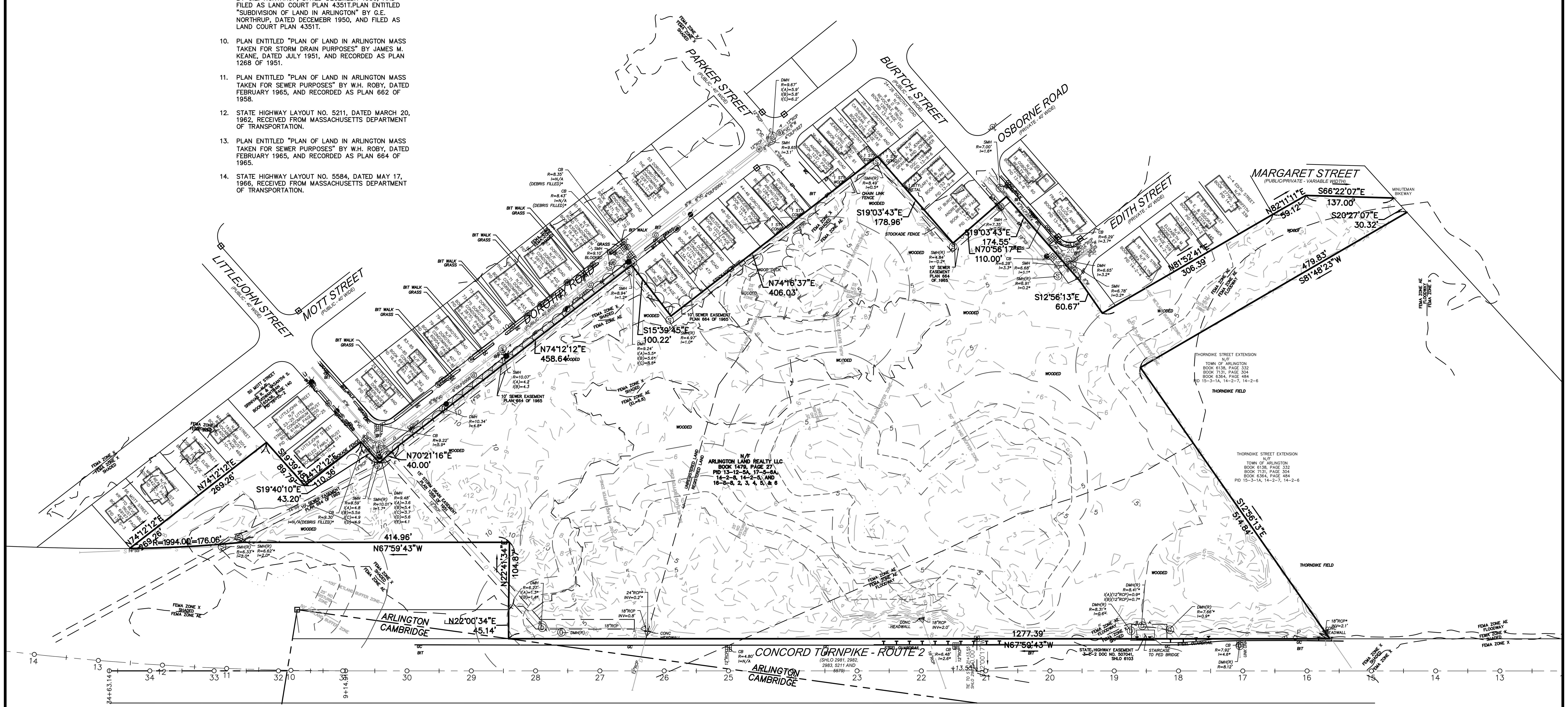
1. PLAN ENTITLED "PLAN AND PROFILE OF LITTLEJOHN STREET" BY FRANK AND DANIEL WYMAN, DATED DECEMBER 1926, AND RECEIVED FROM THE TOWN OF ARLINGTON.
2. PLAN ENTITLED "SUBDIVISION OF LAND IN ARLINGTON" BY BREMER W. POND, DATED APRIL 28, 1927, AND FILED AS LAND COURT PLAN 4351C.
3. PLAN ENTITLED "SUBDIVISION OF LAND SHOWN ON PLAN 4351A" BY J.M. KEANE, DATED OCTOBER 20, 1930, AND FILED AS LAND COURT PLAN 4351G.
4. PLAN ENTITLED "SUBDIVISION OF LAND SHOWN ON PLAN 4351A" BY J.M. KEANE, DATED APRIL 14, 1931, AND FILED AS LAND COURT PLAN 4351H.
5. STATE HIGHWAY LAYOUT NO. 2981, DATED JANUARY 17, 1933, RECEIVED FROM MASSACHUSETTS DEPARTMENT OF TRANSPORTATION.
6. STATE HIGHWAY LAYOUT NO. 2983, DATED JANUARY 17, 1933, RECEIVED FROM MASSACHUSETTS DEPARTMENT OF TRANSPORTATION.
7. PLAN ENTITLED "PLAN OF LAND IN ARLINGTON, MASS" BY C. H. GANNETT CO. CIVIL ENGINEERS, DATED APRIL 30, 1941, AND FILED AS LAND COURT PLAN 18030A.
8. PLAN ENTITLED "SUBDIVISION OF LAND IN ARLINGTON MASS" BY G.E. NORTHRUP, DATED DECEMBER 1948, AND RECORDED AS PLAN 1784 OF 1948.
9. PLAN ENTITLED "SUBDIVISION OF LAND IN ARLINGTON" BY G.E. NORTHRUP, DATED DECEMEBR 1950, AND FILED AS LAND COURT PLAN 4351T.PLAN ENTITLED "SUBDIVISION OF LAND IN ARLINGTON" BY G.E. NORTHRUP, DATED DECEMEBR 1950, AND FILED AS LAND COURT PLAN 4351T.
10. PLAN ENTITLED "PLAN OF LAND IN ARLINGTON MASS TAKEN FOR STORM DRAIN PURPOSES" BY JAMES M. KEANE, DATED JULY 1951, AND RECORDED AS PLAN 1268 OF 1951.
11. PLAN ENTITLED "PLAN OF LAND IN ARLINGTON MASS TAKEN FOR SEWER PURPOSES" BY W.H. ROBY, DATED FEBRUARY 1965, AND RECORDED AS PLAN 662 OF 1958.
12. STATE HIGHWAY LAYOUT NO. 5211, DATED MARCH 20, 1962, RECEIVED FROM MASSACHUSETTS DEPARTMENT OF TRANSPORTATION.
13. PLAN ENTITLED "PLAN OF LAND IN ARLINGTON MASS TAKEN FOR SEWER PURPOSES" BY W.H. ROBY, DATED FEBRUARY 1965, AND RECORDED AS PLAN 664 OF 1965.
14. STATE HIGHWAY LAYOUT NO. 5584, DATED MAY 17, 1966, RECEIVED FROM MASSACHUSETTS DEPARTMENT OF TRANSPORTATION.

GENERAL NOTES

1. THIS PLAN IS BASED UPON AN ON-THE-GROUND SURVEY PERFORMED BY BSC GROUP, INC. IN DECEMBER, 2019 AND JANUARY, 2020.
2. HORIZONTAL DATUM IS BASED UPON NAD '83 (12B) AS DERIVED VIA GPS OBSERVATIONS PERFORMED BY BSC GROUP, INC. IN DECEMBER 2019.
3. VERTICAL DATUM IS BASED UPON NAVD '88 AS DERIVED VIA GPS OBSERVATIONS PERFORMED BY BSC GROUP, INC. IN DECEMBER, 2019.
   TBM 18-1 ELEV=9.13'
   DESC: BACK LEFT BOLT ON HYDRANT ON OSBORNE
   TBM 18-2 ELEV=11.61'
   DESC: FRONT BOLT ON HYDRANT ACROSS FROM UTILITY POLE # 8
   TBM 18-3 ELEV=11.71'
   DESC: BACK LEFT BOLT ON HYDRANT BETWEEN UNITS
4. LOCUS IS LOCATED WITHIN ZONES ZONES AE, AE FLOODWAY, X AND X SHADED AS GRAPHICALLY DEPICTED ON FLOOD INSURANCE RATE MAP NUMBER 25017C0419E, EFFECTIVE DATE JUNE 4, 2010.
5. WETLAND RESOURCE AREAS SHOWN HEREON WERE DELINEATED BY BSC GROUP, INC. IN JANUARY AND OCTOBER 2020.
6. UTILITY RECORDS HEREON DENOTED WITH "*" ARE FROM EXISTING CONDITIONS SURVEY PREPARED BY PRECISION LAND SURVEYING OF SOUTHBOROUGH, MA IN 2009.
7. CONTOURS SHOWN WITHIN WOODED AREAS ARE BASED UPON AERIAL LIDAR COLLECTED UNDER USGS CONTRACT DURING 2013-2014. DATA MEETS OR EXCEEDS QL2 USGS SPECIFICATIONS. BSC GROUP FOUND A MEAN ERROR OF 0.20'(OBSCURED) & 0.16'(UNOBSCURED) ACROSS 15 LOCATIONS SAMPLED DURING THE ON-THE-GROUND SURVEY IN DECEMBER 2019.
8. TOWN LINE LOCATIONS ESTABLISHED FROM MASSACHUSETTS STATE HIGHWAY LAYOUTS 2981, 2982, 2983, 5211 AND 5579.
9. ABUTTING BOUNDARY LINES ARE APPROXIMATE.
10. RECORD UTILITY INFORMATION WAS NOT RECEIVED FROM VERIZON, TENNESSEE GAS AND MCI.

UTILITY NOTE

EXISTING UTILITIES, WHERE SHOWN HEREON, ARE APPROXIMATE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROPERLY LOCATING AND COORDINATING ANY ON-SITE ACTIVITY WITH DIG-SAFE AND THE APPROPRIATE UTILITY COMPANY AND MAINTAINING EXISTING UTILITY SYSTEM SERVICE. DIG-SAFE SHALL BE NOTIFIED PER THE COMMONWEALTH OF MASSACHUSETTS STATUTE CHAPTER 82, SECTION 40, AT 1-888-344-7233. NO GUARANTEE IS IMPLIED OR INTENDED AS TO THE ACCURACY, LOCATION OR THAT ALL UTILITIES AND/OR SUBSURFACE STRUCTURES ARE SHOWN. THE CONTRACTOR SHALL VERIFY SIZE, LOCATION AND INVERTS OR UTILITIES AND STRUCTURES AS REQUIRED PRIOR TO THE START OF CONSTRUCTION.



COMMONWEALTH OF MASSACHUSETTS
SEAN EWALD
No. 47143
PROFESSIONAL LAND SURVEYOR

9/5/23

PROFESSIONAL LAND SURVEYOR FOR BSC GROUP, INC

DATE

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

THORNDIKE PLACE NOTICE OF INTENT

DOROTHY ROAD
IN
ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

EXISTING CONDITIONS

SEPTEMBER 6, 2023

REVISIONS:

NO.	DATE	DESC.

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: 1" = 80'
0 40 80 160 FEET

FILE: 2340702\C\D\2340702-EC
DWG.:
JOB. NO: 23407.02
SHEET V-100

LEGEND

(symbol)	BSC GROUP OCTOBER 2020 WETLAND DELINEATION
(line)	25' NO DISTURB ZONE
(line)	50' BUFFER
(line)	100' BUFFER
(line)	FLOODPLAIN – ZONE AE (EL. 6.8)

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

COMMONWEALTH OF MASSACHUSETTS
DOMINIC R. RINALDI
CIVIL
No. 45074
REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER

THORNDIKE PLACE NOTICE OF INTENT

DOROTHY ROAD
IN
ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

EXISTING ENVIRONMENTAL RESOURCE PLAN

SEPTEMBER 6, 2023

REVISIONS:

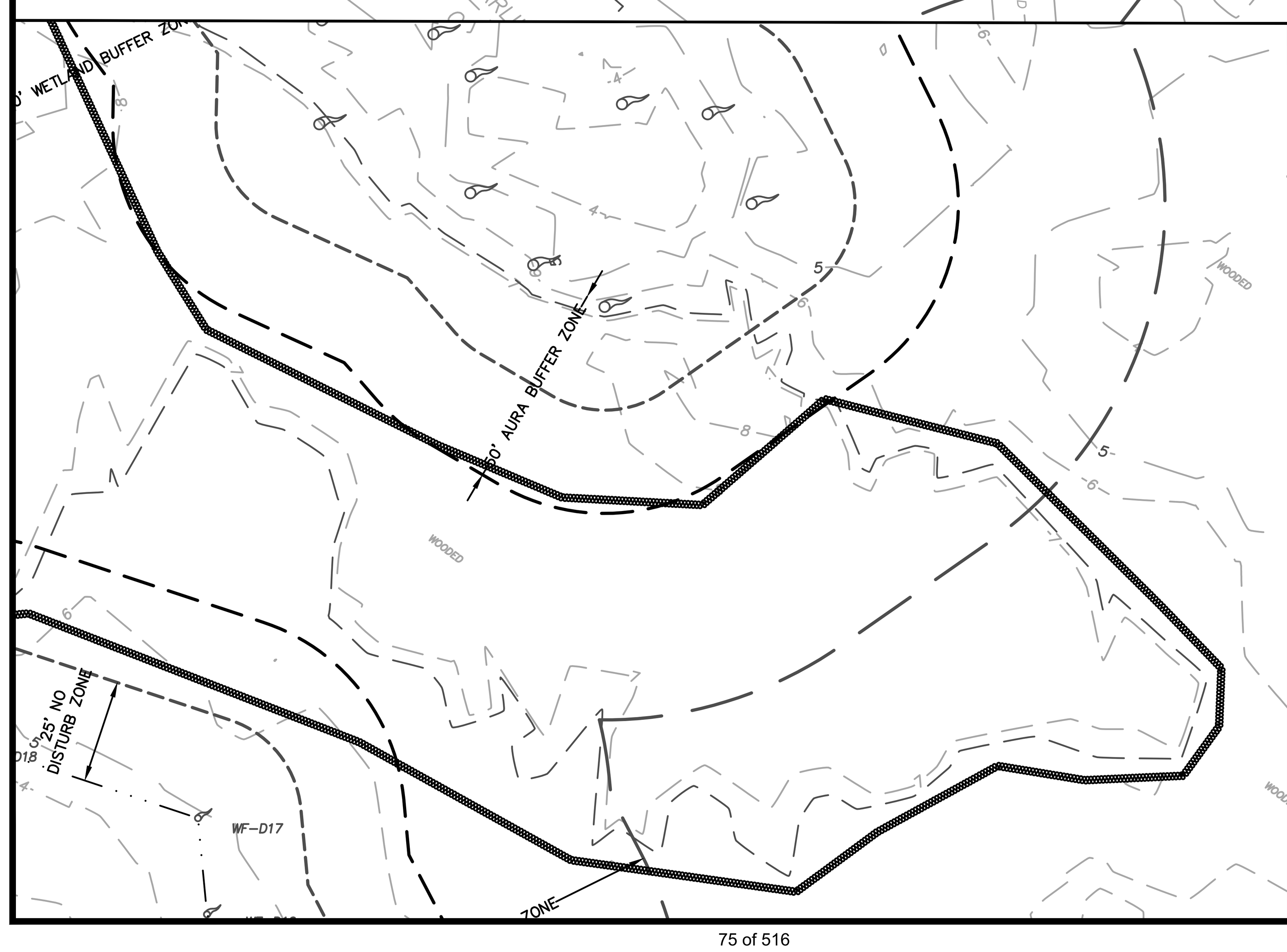
NO.	DATE	DESC.

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: 1" = 50'
0 25 50 100 FEET

FILE: 2340702\C\D\2340702–CONSTRAINTS
DWG.:
JOB. NO: 23407.02
SHEET C–100



EROSION AND SEDIMENT CONTROL NOTES

1. THE PROJECT WORK SHALL COMPLY WITH THE 2022 NPDES CONSTRUCTION GENERAL PERMIT FOR MASSACHUSETTS (CGP). A STORMWATER POLLUTION PREVENTION PLAN (SWPPP) SHALL BE PREPARED AND THE CONTRACTOR SHALL COMPLY WITH ALL REQUIREMENTS OF THE SWPPP. THE CONTRACTOR SHALL PROVIDE EVIDENCE THAT A NOTICE OF INTENT (NOI) HAS BEEN FILED FOR COVERAGE UNDER THE CGP AT LEAST 14 DAYS PRIOR TO THE START OF ANY EARTH DISTURBING ACTIVITES. NO EARTH DISTURBING ACTIVITIES SHALL OCCUR UNTIL THE CONTRACTOR HAS OBTAINED COVERAGE UNDER THE CGP.
2. APPROPRIATE EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSTALLED PRIOR TO SOIL DISTURBANCE. MEASURES SHALL BE TAKEN TO CONTROL EROSION WITHIN THE PROJECT AREA. SEDIMENT IN RUNOFF WATER SHALL BE TRAPPED AND RETAINED WITHIN THE PROJECT AREA.
3. MINIMIZE TOTAL AREA OF DISTURBANCE AND PROTECT NATURAL FEATURES AND SOIL.
4. THE CONTRACTOR SHALL SEQUENCE ALL ACTIVITIES TO MINIMIZE SIMULTANEOUS AREAS OF DISTURBANCE. MASS CLEARING AND GRADING OF THE ENTIRE SITE SHALL BE AVOIDED.
5. MINIMIZE SOIL EROSION AND CONTROL SEDIMENTATION DURING CONSTRUCTION.
6. DIVERT UNCONTAMINATED WATER AROUND DISTURBED AREAS.
7. INSTALL AND MAINTAIN ALL EROSION AND SEDIMENT CONTROL MEASURES IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS AND GOOD ENGINEERING PRACTICES AND IN ACCORDANCE WITH THE 2022 EPA CONSTRUCTION GENERAL PERMIT FOR MASSACHUSETTS.
8. PROTECT AND MANAGE ON AND OFF-SITE MATERIAL STORAGE AREAS (OVERBURDEN AND STOCKPILES OF DIRT, BORROW AREAS, OR OTHER AREAS USED SOLELY BY THE PERMITTED PROJECT SHALL BE CONSIDERED A PART OF THE PROJECT).
9. COMPLY WITH APPLICABLE FEDERAL, STATE AND LOCAL LAWS AND REGULATIONS INCLUDING WASTE DISPOSAL, SANITARY OR SEWER REGULATIONS, AND AIR QUALITY REQUIREMENTS, INCLUDING DUST CONTROL.
10. SEDIMENT SHALL BE REMOVED ONCE THE VOLUME REACHES HALF THE HEIGHT OF THE EROSION CONTROL DEVICE. SEDIMENT SHALL BE REMOVED PRIOR TO REACHING THE LOAD-BEARING CAPACITY OF THE SILT FENCE WHICH MAY BE LOWER THAN HALF THE HEIGHT.

EROSION AND SEDIMENT CONTROL NOTES (CONT.)

11. BMPS TO BE USED FOR INFILTRATION AFTER CONSTRUCTION SHALL NOT BE USED AS BMPS DURING CONSTRUCTION UNLESS OTHERWISE APPROVED BY THE ENGINEER. MANY INFILTRATION TECHNOLOGIES ARE NOT DESIGNED TO HANDLE THE HIGH CONCENTRATIONS OF SEDIMENTS TYPICALLY FOUND IN CONSTRUCTION RUNOFF, AND THUS SHALL BE PROTECTED FROM CONSTRUCTION RELATED SEDIMENT LOADINGS.
12. SOIL STOCKPILE SIDE SLOPES SHALL NOT BE GREATER THAN 2H:IV. ALL STOCKPILES SHALL BE SURROUNDED BY SEDIMENT CONTROLS.
13. A TRACKING PAD OR OTHER APPROVED STABILIZATION METHOD SHALL BE CONSTRUCTED AT ALL CONSTRUCTION ENTRANCE/EXIT POINTS OF THE SITE TO REDUCE THE AMOUNT OF SOIL CARRIED ONTO ROADWAYS AND OFF THE SITE.
14. PERMANENT SEEDING SHALL BE UNDERTAKEN IN THE SPRING FROM MARCH THROUGH MAY, AND IN LATE SUMMER AND EARLY FALL FROM AUGUST TO OCTOBER 15. DURING THE PEAK SUMMER MONTHS AND IN THE FALL AFTER OCTOBER 15, WHEN SEEDING IS FOUND TO BE IMPRACTICAL, APPROPRIATE TEMPORARY STABILIZATION SHALL BE APPLIED. PERMANENT SEEDING MAY BE UNDERTAKEN DURING THE SUMMER IF PLANS PROVIDE FOR ADEQUATE MULCHING AND WATERING.
15. TEMPORARY SEDIMENT TRAPPING DEVICES SHALL NOT BE REMOVED UNTIL PERMANENT STABILIZATION IS ESTABLISHED IN ALL CONTRIBUTORY DRAINAGE AREAS.
16. ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REMOVED AFTER FINAL SITE STABILIZATION DISTURBED SOIL AREAS RESULTING FROM THE REMOVAL OF TEMPORARY MEASURES SHALL BE PERMANENTLY STABILIZED WITHIN 30 DAYS OF REMOVAL.
17. DUST SHALL BE CONTROLLED AT THE SITE.
18. ALL PREVIOUSLY DISTURBED LAND SHALL BE STABILIZED BY APPROVED METHODS AFTER 14 DAYS IF LEFT UNDISTURBED, THIS INCLUDES STOCKPILES, CONSTRUCTION ENTRANCES, GRADED AREAS AND OTHER CONSTRUCTION ACTIVITY RELATED CLEARING.
19. IF WORK IS HALTED OVER WINTER MONTHS THE CONTRACTOR SHALL BE RESPONSIBLE FOR STABILIZING THE AREA THROUGH GROUND COVER PRACTICES.

GENERAL NOTES:

1. ALL EXISTING UTILITY STRUCTURES, CONDUITS, AND APPURTENANCES OF ANY KIND SHALL BE COMPLETELY REMOVED WITHIN THE LIMITS OF EXCAVATION FOR NEW BUILDINGS, UNLESS NOTED OTHERWISE ON THE DRAWINGS. OUTSIDE THE LIMITS OF EXCAVATION FOR NEW BUILDINGS, ALL ABANDONED AND TO-BE-ABANDONED UTILITIES GREATER THAN 8 INCHES IN DIAMETER SHALL BE SEALED BY FILLING WITH HIGH SLUMP CONCRETE (FLOWABLE FILL) AT THE LIMIT OF EXCAVATION. ALL UTILITY STRUCTURES TO BE REMOVED SHALL HAVE THE ASSOCIATED PIPES REMOVED TO A DISTANCE OF 15 FEET FROM THE STRUCTURE AND SEALED.
2. CONSTRUCTION SETUP IS SHOWN FOR REFERENCE ONLY. EROSION AND SEDIMENTATION CONTROLS TO BE APPROPRIATELY SIZED AND LOCATED/RELOCATED BY THE CONTRACTOR DURING EARTHWORK OPERATIONS.
3. CONTRACTOR SHALL WORK WITH LANDSCAPE ARCHITECT TO DETERMINE SCOPE OF TREE WORK.
4. ALL CONSTRUCTION FENCING AND WARNING SIGNS SHALL BE INSTALLED PRIOR TO ANY CONSTRUCTION. INSTALL CONSTRUCTION FENCING AT THE LIMIT OF WORK.
5. PRIOR TO THE TERMINATION, ABANDONMENT, OR REMOVAL OF ANY UTILITY, VERIFY THAT APPLICABLE NOTIFICATIONS HAVE BEEN MADE TO THE UTILITY OWNER/OPERATOR AND THAT THE UTILITY HAS BEEN PROPERLY TERMINATED, CAPPED, OR PLUGGED AS REQUIRED.
6. PROTECT ALL IMPROVEMENTS NOT INCLUDED IN THE SCOPE OF SITE DEMOLITION. ANY IMPROVEMENT WHICH IS DAMAGED SHALL BE REPAIRED OR REPLACED IN-KIND TO THE OWNER'S SATISFACTION AT NO ADDITIONAL COST.
7. UNLESS OTHERWISE INDICATED, ALL DISTURBED AREAS SHALL BE RESTORED WITH SIX (6) INCHES OF LOAM, SEEDED, FERTILIZED, AND MULCHED. PROVIDE ADDITIONAL EROSION CONTROLS AS REQUIRED.

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

PROFESSIONAL ENGINEER

THORNDIKE PLACE NOTICE OF INTENT

DOROTHY ROAD
IN
ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

SITE PREPARATION PLAN

SEPTEMBER 6, 2023

REVISIONS:

NO.	DATE	DESC.
1	9/12/24	INFILTRATION SYSTEM
2	12/10/24	PEER REVIEW REVISIONS

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: 1" = 30'
0 15 30 60 FEET

FILE: 2340702\C\D\2340702-PREP
DWG.:
JOB. NO: 23407.02
SHEET C-101

LEGEND

	BSC GROUP OCTOBER 2020 WETLAND DELINEATION
	25' NO DISTURB ZONE
	50' BUFFER
	100' BUFFER
	FLOODPLAIN – ZONE AE (EL. 6.8)

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

COMMONWEALTH OF MASSACHUSETTS
DOMINIC R. RINALDI
CIVIL
No. 45074
REGISTERED PROFESSIONAL ENGINEER

PROFESSIONAL ENGINEER

THORNDIKE PLACE NOTICE OF INTENT

DOROTHY ROAD

IN

ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

OVERALL SITE PLAN

SEPTEMBER 6, 2023

REVISIONS:

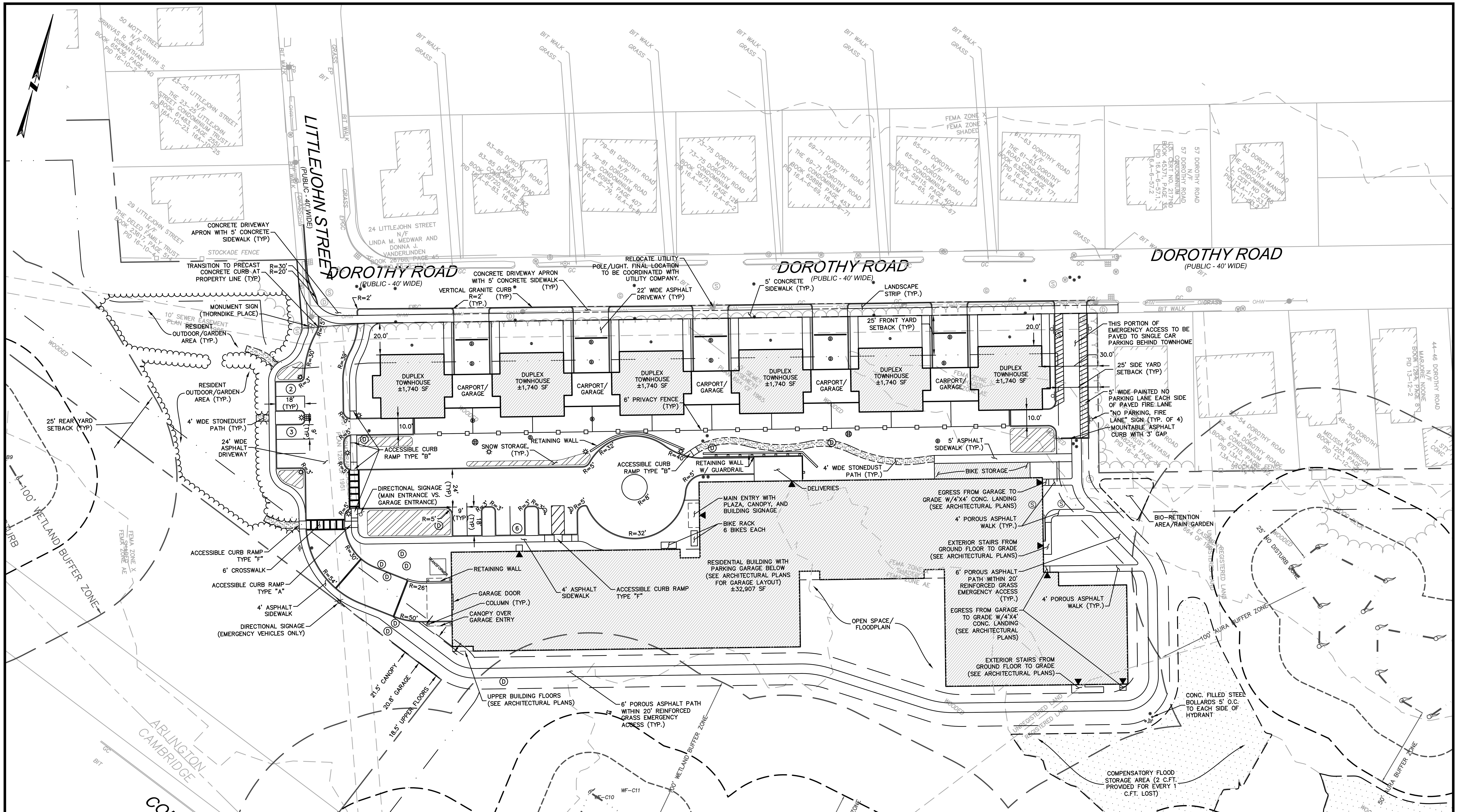
NO.	DATE	DESC.

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: 1" = 50'
0 25 50 100 FEET

FILE: 2340702\C\D\2340702–SP2
DWG.:
JOB. NO: 23407.02
SHEET C–102



ZONING ANALYSIS TABLE		
ZONING DISTRICT	PUD – PLANNED UNIT DEVELOPMENT	
ZONING CRITERIA	REQUIRED	PROVIDED
MIN LOT AREA	200,000 SF	769,359 SF
MIN FRONT YARD	25'*	20.0'
MIN SIDE YARD	25'*	30.0'
MIN REAR YARD	25'*	20.8' GARAGE / 18.5' UPPER FLOORS
MAX BLDG HEIGHT	85', 5 STORIES	4 STORIES + GARAGE
MAX FAR	0.80	0.22 / 0.69***
LANDSCAPED OPEN SPACE	10%	>10%
USABLE OPEN SPACE	10%	±4%

*YARD SETBACKS IN PUD ARE EQUAL TO ¼ OF THE HEIGHT OF THE AVERAGE OF THE PRINCIPAL BUILDINGS ALONG THE LOT LINE, NO LESS THAN 25'
**AREAS BASED ON LIMITS OF PROJECT DISTURBANCE
***FAR OF 0.22 BASED ON FULL ±17.7 ACRE PARCEL. FAR OF 0.69 BASED ON ±5.66 ACRE PARCEL SHOWN ON PROPOSED CONSERVATION RESTRICTION PLAN.

REQUIRED/PROVIDED PARKING TABLE		
UNIT COUNTS	REQUIRED	PROVIDED
124 UNITS (ASSISTED LIVING)	50 (0.4 SPACE/UNIT)	118 (SEE BELOW)
12 DUPLEX	24 (2 SPACES/UNIT)	
TOTAL	74	

PARKING BREAKDOWN

	PROVIDED	HCP.–ACCESSIBLE REQUIRED
GARAGE	86 (82 STANDARD; 4 HCP. SPACES; ALL OF WHICH ARE VAN–ACCESSIBLE)	MIN. 4 HCP. SPACES – AT LEAST 1 OF WHICH IS VAN–ACCESSIBLE (REFER TO ARCHITECTURAL PLANS)
SURFACE	11 (9 STANDARD; 2 HCP. SPACES, BOTH ARE VAN–ACCESSIBLE)	NONE
DUPLEXES	22 (10 GARAGE/CARPORT; 10 DRIVEWAY; 2 REAR DRIVEWAY)	NONE
TOTAL	119 (113 STANDARD; 6 HCP. SPACES; ALL OF WHICH ARE VAN–ACCESSIBLE)	MIN. 4 HCP. SPACES – AT LEAST 1 OF WHICH IS VAN–ACCESSIBLE

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

PROFESSIONAL ENGINEER

THORNDIKE PLACE NOTICE OF INTENT

DOROTHY ROAD
IN
ARLINGTON MASSACHUSETTS
(MIDDLESEX COUNTY)

LAYOUT & MATERIALS PLAN

SEPTEMBER 6, 2023

REVISIONS:

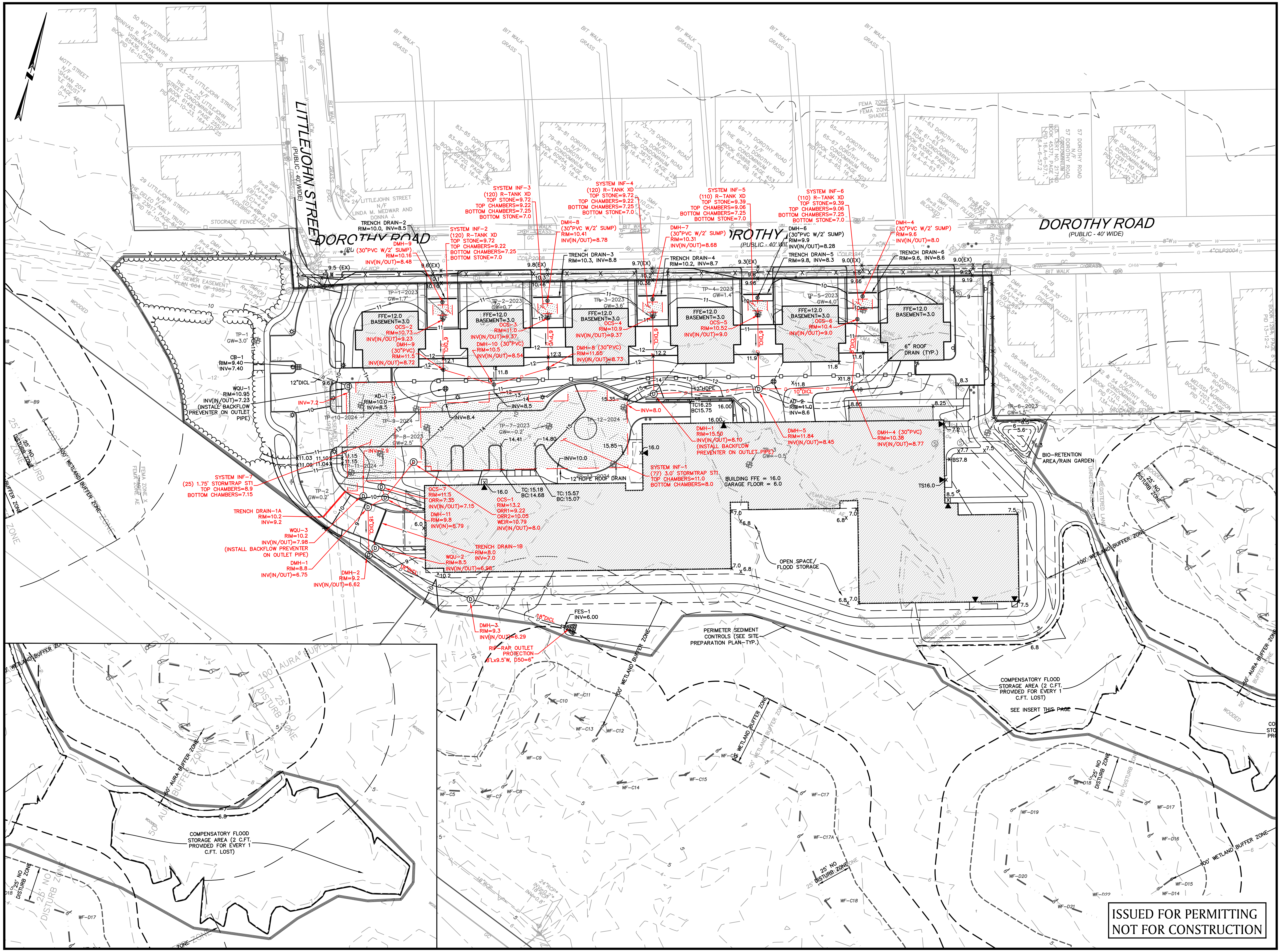
NO.	DATE	DESC.
1	9/12/24	INFILTRATION SYSTEM
2	12/10/24	PEER REVIEW REVISIONS

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: 1" = 30'
0 15 30 60 FEET

FILE: 2340702\C\D\2340702-LM
DWG.:
JOB. NO: 23407.02
SHEET C-103



PROFESSIONAL ENGINEER

THORNDIKE PLACE NOTICE OF INTENT

DOROTHY ROAD

IN

ARLINGTON MASSACHUSETTS

(MIDDLESEX COUNTY)

GRADING & DRAINAGE PLAN

SEPTEMBER 6, 2023

REVISIONS:

NO.	DATE	DESC.
1	9/12/24	INFILTRATION SYSTEM
2	12/10/24	PEER REVIEW REVISIONS

PREPARED FOR:

ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: 1" = 30'

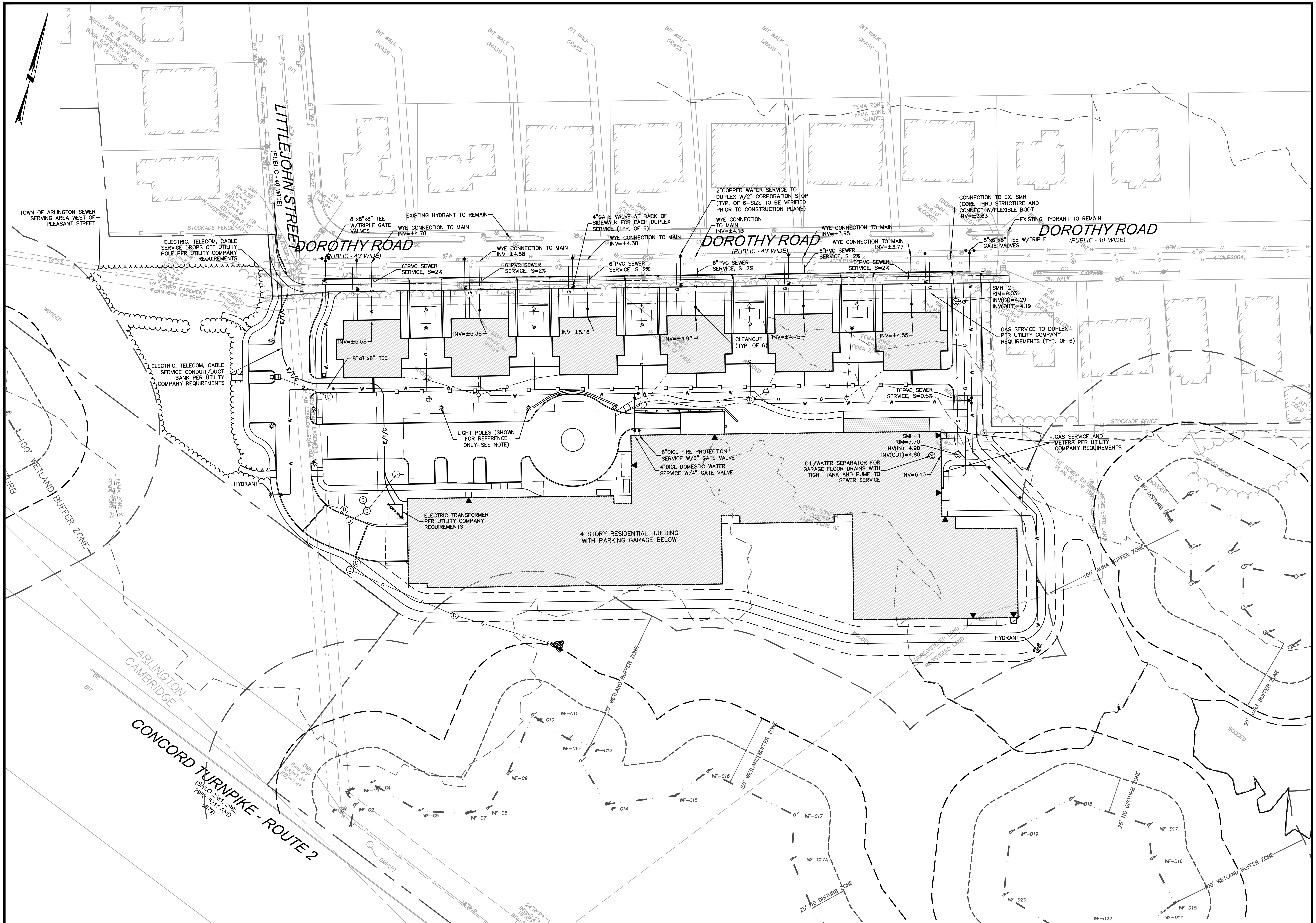
0 15 30 60 FEET

FILE: 2340702\C\D\2340702-GR

DWG.:

JOB. NO: 23407.02

SHEET C-104



NOTE: FINAL SITE LIGHTING PLANS TO MEET TOWN OF ARLINGTON REGULATION OF OUTDOOR LIGHTING AND SHALL NOT SHINE BRIGHTLY OR CREATE GLARE ON ADJACENT PROPERTIES/STREETS.

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

PROFESSIONAL ENGINEER

THORNDIKE PLACE NOTICE OF INTENT

DOROTHY ROAD
IN
ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

UTILITY PLAN

SEPTEMBER 6, 2023

REVISIONS:

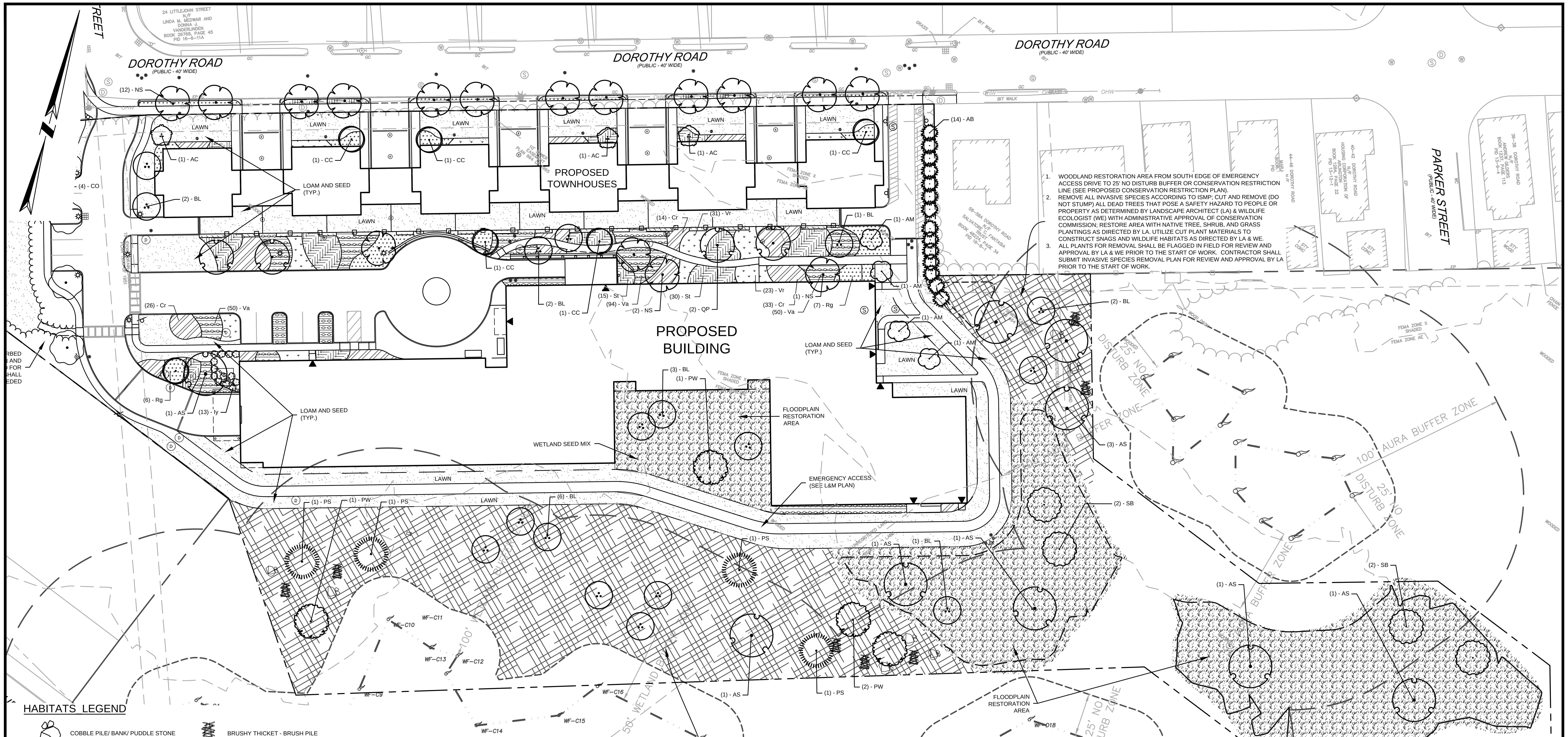
NO.	DATE	DESC.
1	9/12/24	INFILTRATION SYSTEM
2	12/10/24	PEER REVIEW REVISIONS

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: 1" = 30'
0 15 30 60 FEET

FILE: 2340702\C\D\2340702-UT
DWG.:
JOB. NO: 23407.02
SHEET C-105



1. WOODLAND RESTORATION AREA FROM SOUTH EDGE OF EMERGENCY ACCESS DRIVE TO 25' NO DISTURB BUFFER OR CONSERVATION RESTRICTION LINE (SEE PROPOSED CONSERVATION RESTRICTION PLAN).
2. REMOVE ALL INVASIVE SPECIES ACCORDING TO ISMP; CUT AND REMOVE (DO NOT STUMP) ALL DEAD TREES THAT POSE A SAFETY HAZARD TO PEOPLE OR PROPERTY AS DETERMINED BY LANDSCAPE ARCHITECT (LA) & WILDLIFE ECOLOGIST (WE) WITH ADMINISTRATIVE APPROVAL OF CONSERVATION COMMISSION; RESTORE AREA WITH NATIVE TREE, SHRUB, AND GRASS PLANTINGS AS DIRECTED BY LA. UTILIZE CUT PLANT MATERIALS TO CONSTRUCT SNAGS AND WILDLIFE HABITATS AS DIRECTED BY LA & WE.
3. ALL PLANTS FOR REMOVAL SHALL BE FLAGGED IN FIELD FOR REVIEW AND APPROVAL BY LA & WE PRIOR TO THE START OF WORK. CONTRACTOR SHALL SUBMIT INVASIVE SPECIES REMOVAL PLAN FOR REVIEW AND APPROVAL BY LA PRIOR TO THE START OF WORK.

HABITATS LEGEND

COBBLE PILE/ BANK/ PUDDLE STONE

BRUSHY THICKET - BRUSH PILE

PLANT SCHEDULE

CODE	QTY	BOTANICAL / COMMON NAME	CONT	CAL	HT		REMARKS
TREES							
AB	14	ABIES BALSAMEA BALSAM FIR	B & B	2-2.5" CAL.			
AS	9	ACER SACCHARINUM SILVER MAPLE	B & B	2.5-3" CAL.			
BL	17	BETULA LENTA SWEET BIRCH	B & B		8`-10`		
CC	8	CARPINUS CAROLINIANA AMERICAN HORNBEAM	B & B	2-2.5" CAL.			
CO	4	CELTIS OCCIDENTALIS COMMON HACKBERRY	B & B	2-2.5" CAL.			
NS	16	NYSSA SYLVATICA `BLACK TUPELO` SOUR GUM	B & B	2.5-3" CAL.			
PS	4	PINUS STROBUS WHITE PINE	B & B		8`-10`		
PW	4	PRUNUS SEROTINA BLACK CHERRY	B & B	2-2.5" CAL.			
QP	4	QUERCUS PALUSTRIS PIN OAK	B & B	2.5-3" CAL			
SB	4	SALIX NIGRA BLACK WILLOW	B & B	2-2.5" CAL.			
ORNAMENTAL TREES							
AM	4	AMELANCHIER CANADENSIS CANADIAN SERVICEBERRY MULTI-TRUNK	B & B	10`-12` CLUMP			
AC	6	AMELANCHIER CANADENSIS CANADIAN SERVICEBERRY	B & B	2.5-3" CAL			SINGLE STEM
CODE	QTY	BOTANICAL / COMMON NAME	CONT	HT.			REMARKS
SHRUBS							
Iy	13	ILEX GLABRA INKBERRY	2 GAL				
SYMBOL	QTY	BOTANICAL / COMMON NAME	CONT			SPACING	REMARKS
SHRUBS & GROUNDCOVERS							
	261	CLETHRA ALNIFOLIA CLETHRA	3 GAL			36" o.c.	
	424	GAULTHERIA PROCUMBENS WINTERGREEN	FLAT			12" o.c.	
	74	RHUS AROMATICA `GRO-LOW` GRO-LOW FRAGRANT SUMAC	3 GAL			72" o.c.	
	320	SPIRAEA TOMENTOSA STEEPLEBUSH	2 GAL			36" o.c.	
	835	VACCINIUM ANGUSTIFOLIUM LOWBUSH BLUEBERRY	3 GAL			24" o.c.	
	200	VERONICASTRUM VIRGINICUM CULVER'S ROOT	2 GAL			36" o.c.	

1. WOODLAND RESTORATION AREA FROM SOUTH EDGE OF EMERGENCY ACCESS DRIVE TO 25' NO DISTURB BUFFER OR CONSERVATION RESTRICTION LINE (SEE PROPOSED CONSERVATION RESTRICTION PLAN).
2. REMOVE ALL INVASIVE SPECIES ACCORDING TO ISMP; CUT AND REMOVE (DO NOT STUMP) ALL DEAD TREES THAT POSE A SAFETY HAZARD TO PEOPLE OR PROPERTY AS DETERMINED BY LANDSCAPE ARCHITECT (LA) & WILDLIFE ECOLOGIST (WE) WITH ADMINISTRATIVE APPROVAL OF CONSERVATION COMMISSION; RESTORE AREA WITH NATIVE TREE, SHRUB, AND GRASS PLANTINGS AS DIRECTED BY LA. UTILIZE CUT PLANT MATERIALS TO CONSTRUCT SNAGS AND WILDLIFE HABITATS AS DIRECTED BY LA & WE.
3. ALL PLANTS FOR REMOVAL SHALL BE FLAGGED IN FIELD FOR REVIEW AND APPROVAL BY LA & WE PRIOR TO THE START OF WORK. CONTRACTOR SHALL SUBMIT INVASIVE SPECIES REMOVAL PLAN FOR REVIEW AND APPROVAL BY LA PRIOR TO THE START OF WORK.

SEED MIX FOR LAWN AREA

Botanical Name	Common Name
Festuca rubra	Red Fescue
Schizachyrium scoparium	Little Bluestem
Panicum virgatum	Switch Grass
Elymus virginicus	Virginia Wild Rye
Andropogon gerardii	Big Bluestem
Sorghastrum nutans	Indian Grass
Chamaecrista fasciculata	Partridge Pea
Agrostis perennans	Upland Bentgrass
Juncus tenuis	Path Rush
Juncus effusus	Soft Rush

SEED MIX FOR WOODLAND & FLOODPLAIN RESTORATION AREAS

Botanical Name	Common Name
Asclepias syriaca	Common Milkweed
Asclepias incarnata	Swamp Butterfly Weed
Symphyotrichum novae-angliae	New England Aster
Chamaecrista fasciculata	Partridge Pea
Elymus canadensis	Canada Wild Rye
Elymus virginicus	Virginia Wild Rye
Festuca rubra	Red Fescue
Rudbeckia laciniata	Green-headed Coneflower
Schizachyrium scoparium	Little Bluestem
Solidago juncea	Early Goldenrod
Sorghastrum nutans	Indiangrass
Symphyotrichum novi-belgii	New York Aster
Baptisia tinctoria	Horseflyweed
Desmodium canadense	Showy Tick Trefoil
Euthamia graminifolia	Flat-top Goldentop
Pycnanthemum virginianum	Virginia Mountain Mint

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

MASSACHUSETTS
RICARDO R. AUSTRIA
NO. 1248
REGISTERED LANDSCAPE ARCHITECT

REGISTERED LANDSCAPE ARCHITECT

THORNDIKE PLACE NOTICE OF INTENT

DOROTHY ROAD
IN
ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

PLANTING PLAN

SEPTEMBER 6, 2023

REVISIONS:

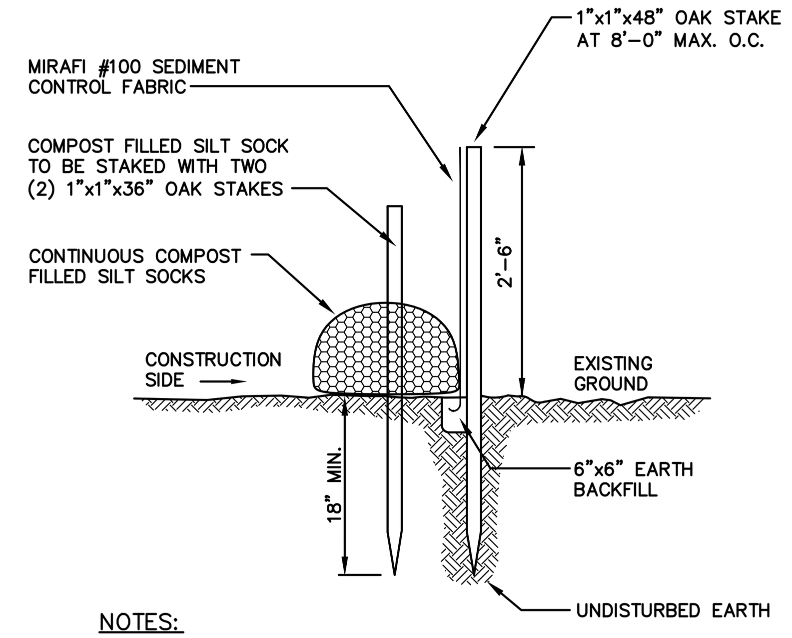
NO.	DATE	DESC.
1	02/07/24 / 09/12/24	INFILTRATION SYSTEM / REV. RESTORATION AREA
2	03/07/24 / 12/07/24	PEER REVIEW REVISIONS / REV. RESTORATION AREA

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: 1" = 30'
0 15 30 60 FEET

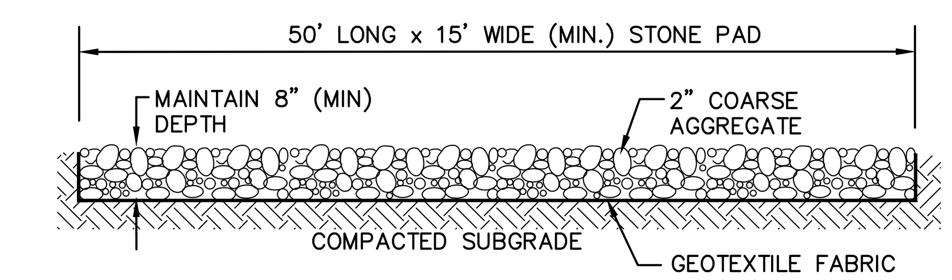
FILE: \Civil_Drawings\2340700-LM
DWG.:
JOB. NO: 23407.02
SHEET L-100



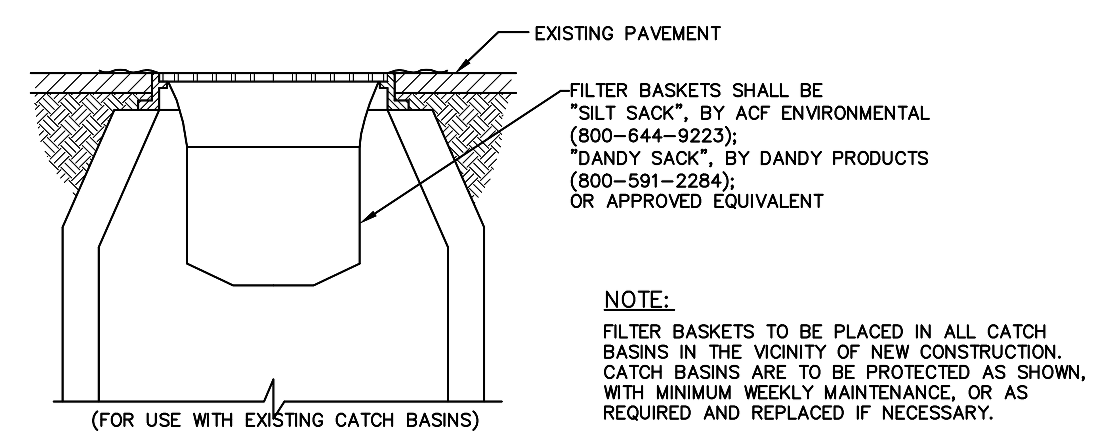
NOTES:

1. SILT SOCKS SHALL BE PLACED IN A ROW WITH THE ENDS TIGHTLY ABUTTING THE ADJACENT SILT SOCKS.
2. SILT SOCKS SHALL BE SECURELY ANCHORED IN PLACE BY TWO (2) 1"X1"X36" OAK STAKES DRIVEN THROUGH THE SILT SOCKS. THE FIRST STAKE IN EACH SILT SOCK SHALL BE ANGLED TOWARD PREVIOUSLY LAID SILT SOCK TO FORCE SILT SOCKS TOGETHER.
3. INSPECTION SHALL BE FREQUENT AND REPAIR OR REPLACEMENT SHALL BE MADE PROMPTLY AS NEEDED.
4. SILT SOCKS SHALL BE REMOVED AND REPLACED WHEN THEY BECOME FILLED WITH SEDIMENT AND BLOCK OR IMPEDE STORM FLOW OR DRAINAGE.
5. SILT SOCKS SHALL BE REMOVED WHEN THE EMBANKMENTS STABILIZE.

SILT FENCE WITH COMPOST FILLED SILT SOCK
SCALE: NONE

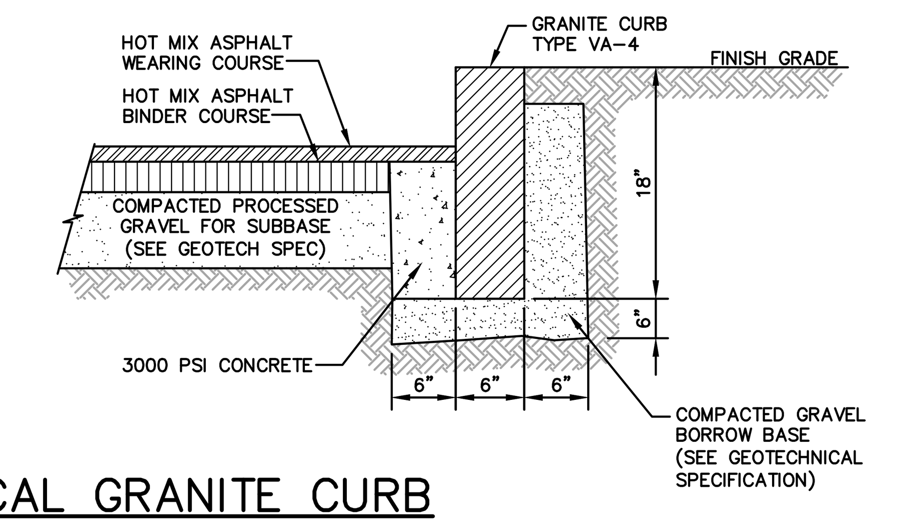


TEMPORARY CONSTRUCTION ENTRANCE
SCALE: NONE

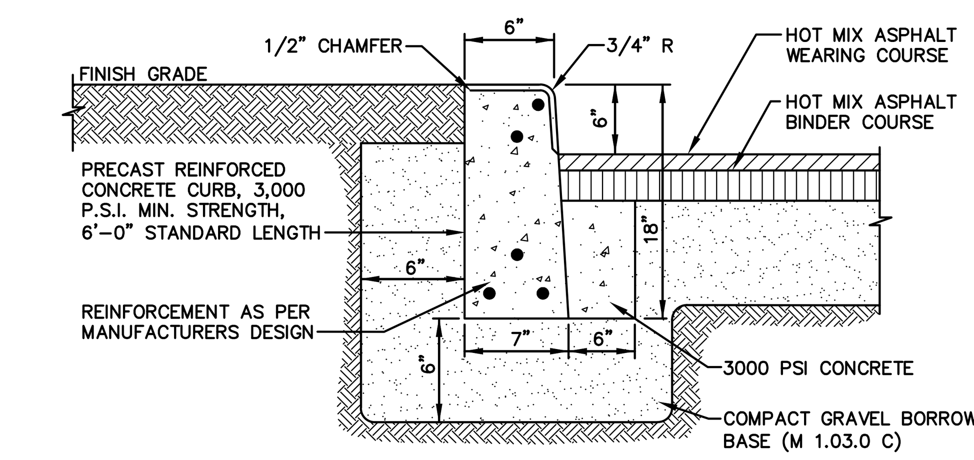


NOTE:
FILTER BASKETS TO BE PLACED IN ALL CATCH BASINS IN THE VICINITY OF NEW CONSTRUCTION. CATCH BASINS ARE TO BE PROTECTED AS SHOWN, WITH MINIMUM WEEKLY MAINTENANCE, OR AS REQUIRED AND REPLACED IF NECESSARY.

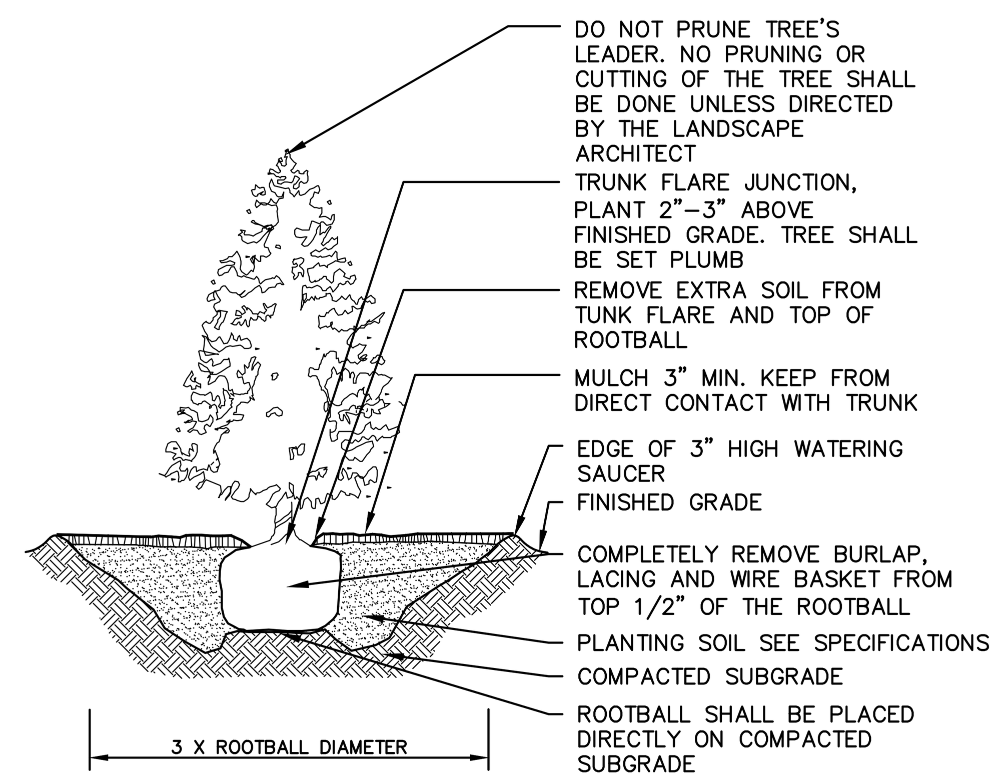
CATCH BASIN INLET PROTECTION
SCALE: NONE



VERTICAL GRANITE CURB
SCALE: NONE



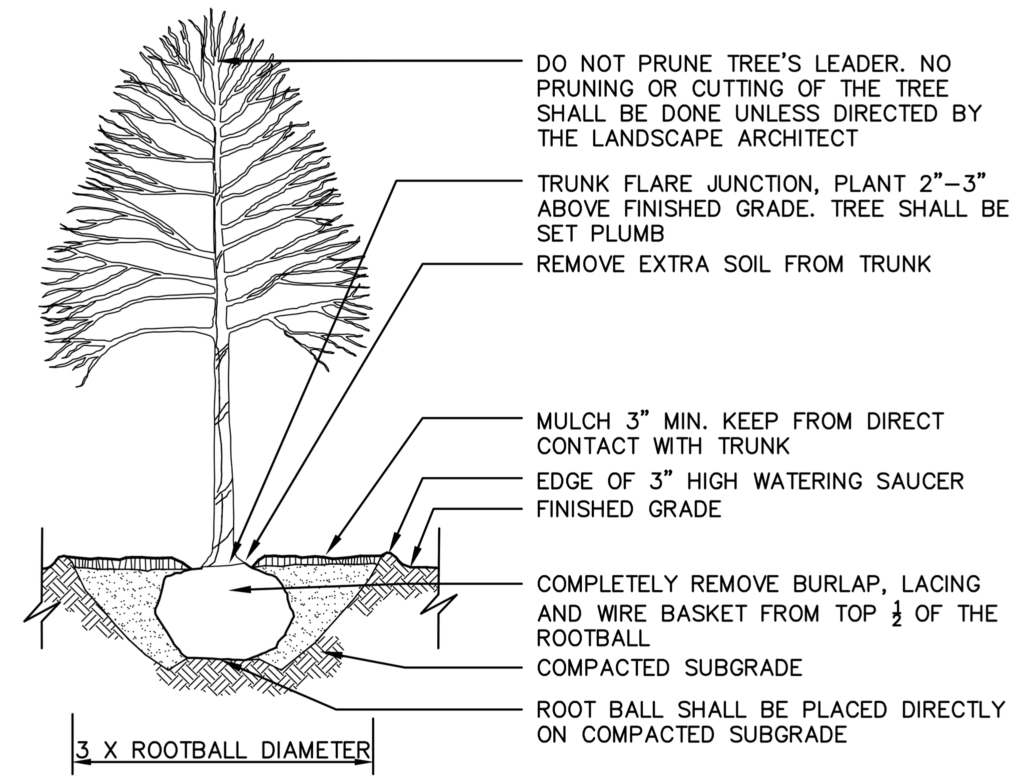
PRECAST CONCRETE CURB
SCALE: NONE



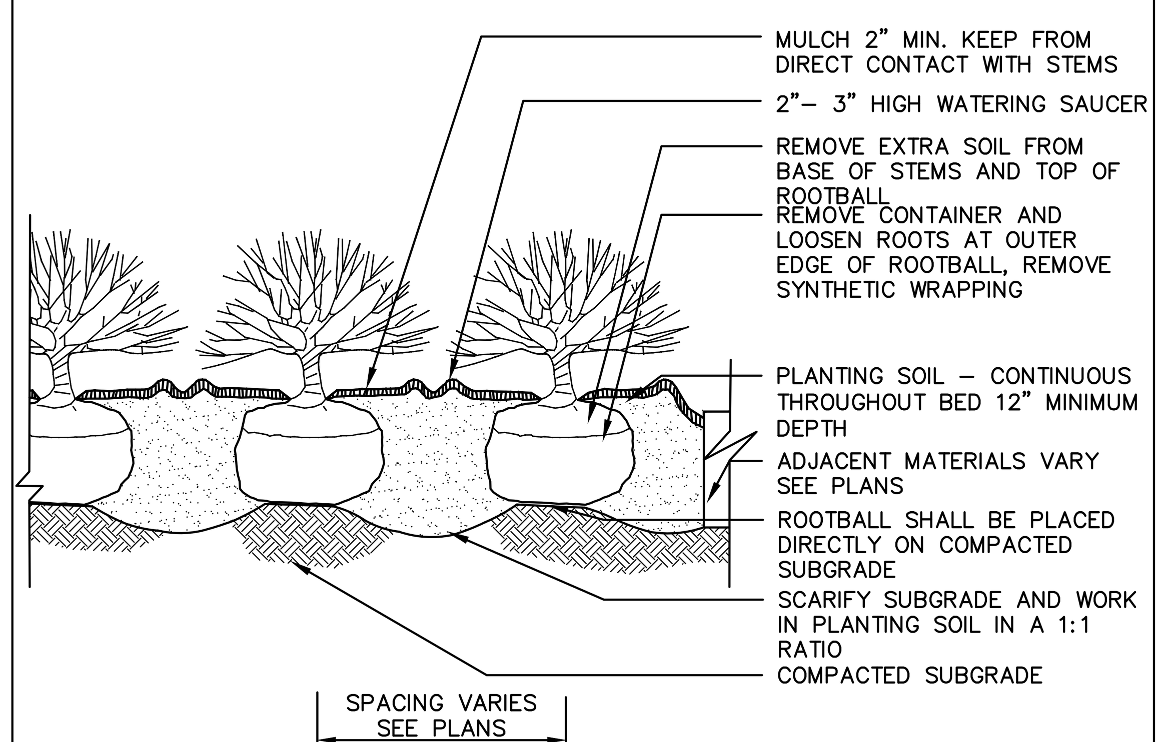
NOTE:
1. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
2. SAUCER SHALL BE FLOODED TWICE DURING THE FIRST 24 HOURS AFTER PLANTING.

EVERGREEN TREE PLANTING DETAIL
SCALE: NONE

NOTES:
1. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
2. CONTRACTOR RESPONSIBLE FOR MAINTAINING TREES IN A PLUMB CONDITION.
3. SAUCER SHALL BE FLOODED TWICE DURING THE FIRST 24 HOURS AFTER PLANTING.

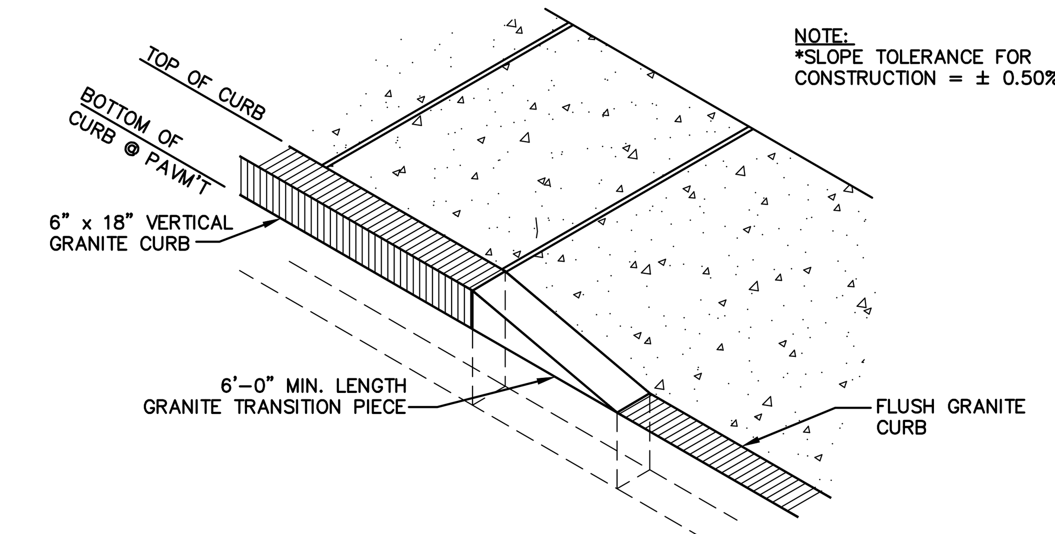


DECIDUOUS TREE PLANTING DETAIL
SCALE: NONE



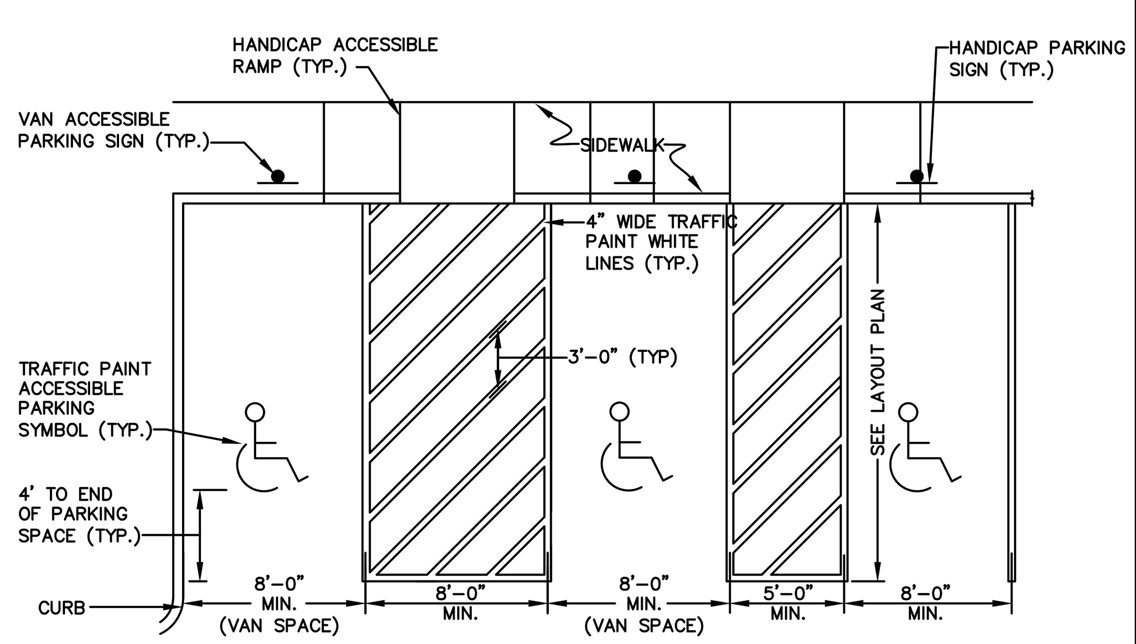
NOTES:
1. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
2. NO PRUNING OR CUTTING UNLESS DIRECTED BY THE LANDSCAPE ARCHITECT.
3. SAUCER SHALL BE FLOODED TWICE DURING THE FIRST 24 HOURS AFTER PLANTING.
4. SHRUBS SHALL BE SET PLUMB AND PLANTED SO THAT THE TOP OF THE ROOTBALL IS 1"-2" ABOVE FINISHED GRADE.

SHRUB PLANTING BED
SCALE: NONE

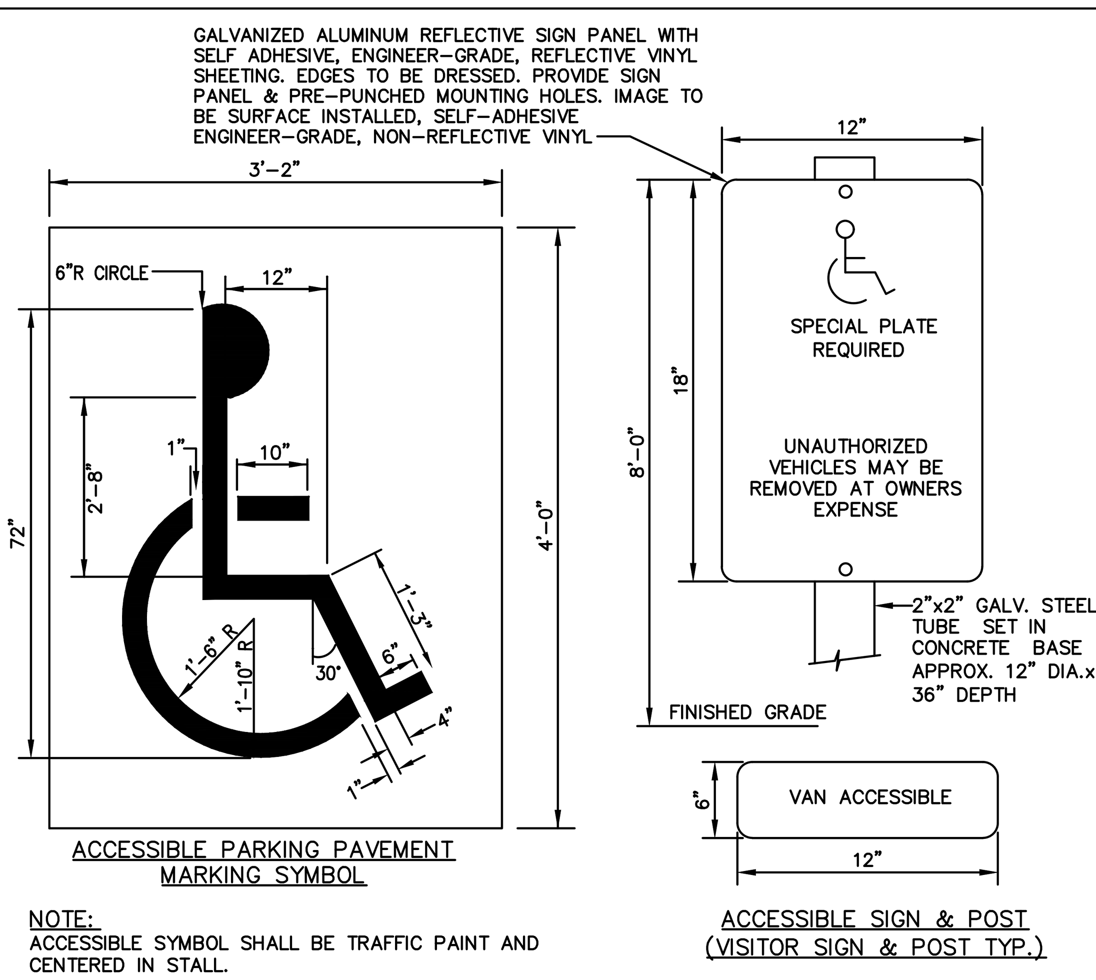


NOTE:
*SLOPE TOLERANCE FOR CONSTRUCTION = ± 0.50%

GRANITE CURB TRANSITION
SCALE: NONE

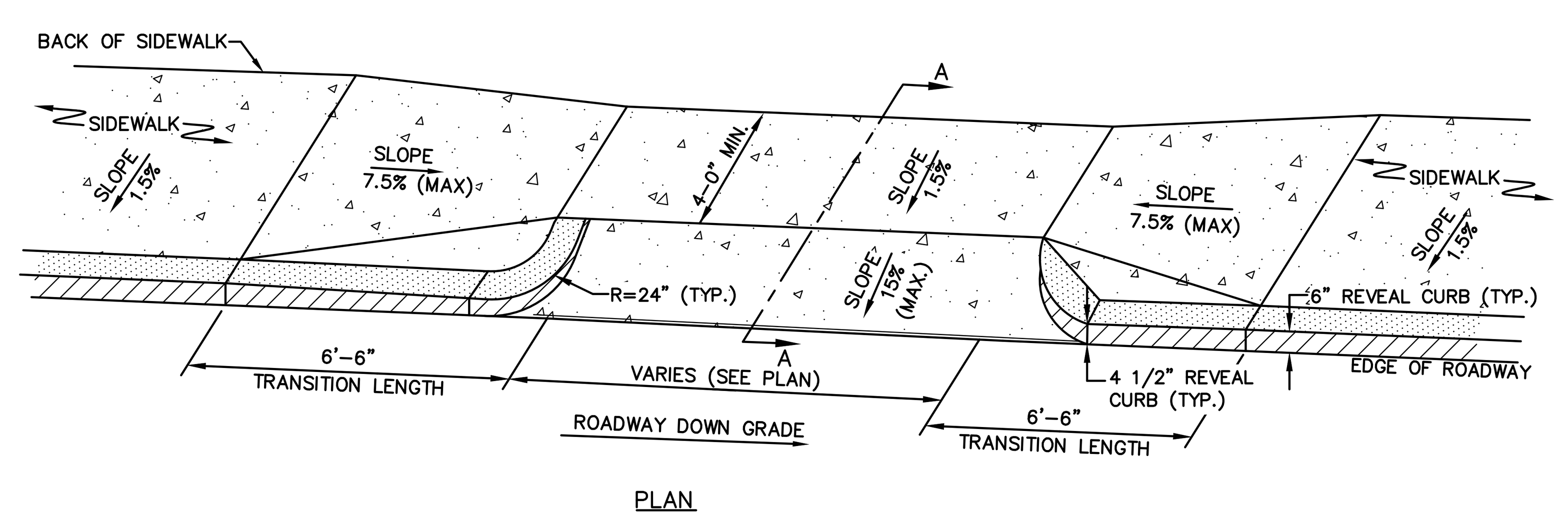


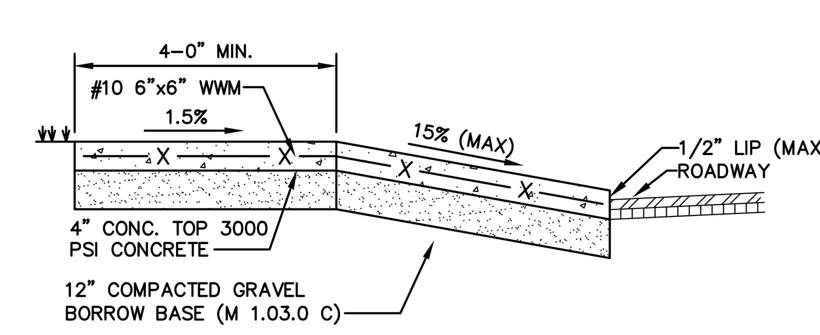
PAINTED PAVEMENT MARKINGS ACCESSIBLE PARKING SPACE
SCALE: NONE



NOTE:
ACCESSIBLE SYMBOL SHALL BE TRAFFIC PAINT AND CENTERED IN STALL.

PAINTED PAVEMENT MARKINGS ACCESSIBLE PARKING SYMBOL & ACCESSIBLE PARKING SIGN
SCALE: NONE





CURB TRANSITION LENGTH FOR WHEELCHAIR RAMPS	
ROADWAY PROFILE GRADE (%)	HIGH SIDE TRANSITION LENGTH ROUNDED TO THE NEAREST 4"
0 OR LOW SIDE	6'-6"
>0 - 1	7'-8"
>1 - 2	9'-0"
>2 - 3	11'-0"
>3 - 4	14'-0"
>4	15'-0" (MAX)

NOTES:
1. BASED ON A DESIGN SLOPE OF 7.5% & A REVEAL OF 6".
2. SLOPE TOLERANCE FOR CONSTRUCTION = ± 0.50%
3. THE MAX. ALLOWABLE SLOPE OF ACCESSIBLE ROUTE EXCLUDING CURB RAMPS SHALL BE 5%.
4. THE MAX. ALLOWABLE SLOPE OF ACCESSIBLE ROUTE CURB RAMPS SHALL BE 7.5%
5. A MINIMUM OF 3 FEET CLEAR SHALL BE MAINTAINED AT ANY PERMANENT OBSTACLE IN ACCESSIBLE ROUTE (I.E. HYDRANTS, UTILITY POLES, TREE WELLS, SIGNS, ETC.).
6. BASE OF RAMP SHALL BE GRADED TO PREVENT PONDING.

SIDEWALK THROUGH DRIVEWAY - TYPE 1
SCALE: NONE

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

PROFESSIONAL ENGINEER

THORNDIKE PLACE NOTICE OF INTENT

DOROTHY ROAD
IN
ARLINGTON MASSACHUSETTS
(MIDDLESEX COUNTY)

CIVIL & LANDSCAPE DETAILS

SEPTEMBER 6, 2023

REVISIONS:

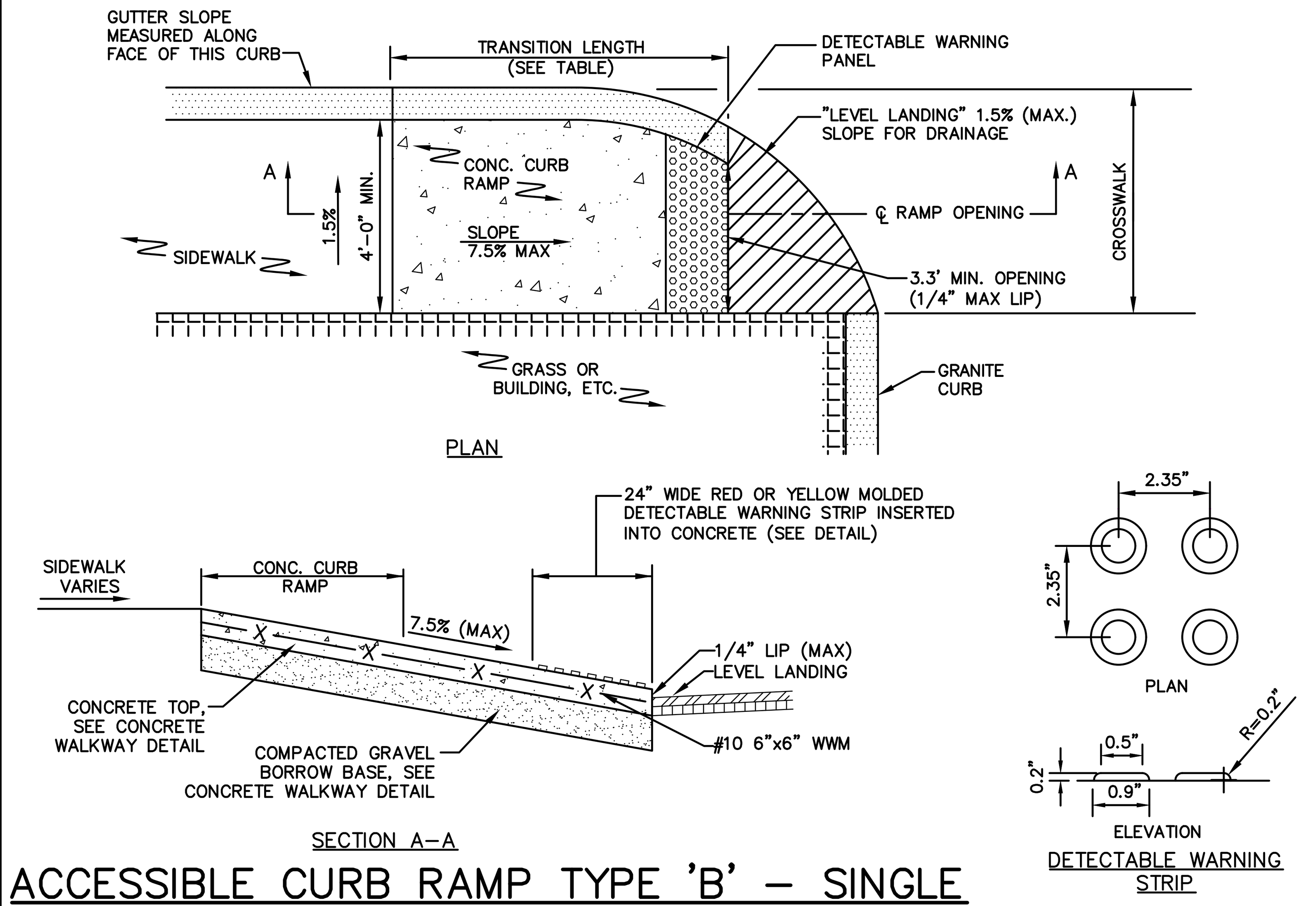
NO.	DATE	DESC.
1	9/12/24	INFILTRATION SYSTEM
2	12/10/24	PEER REVIEW REVISIONS

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: AS NOTED
FEET

FILE: 2340702\C\D\2340702-DET
DWG.:
JOB. NO: 23407.02
SHEET C-200

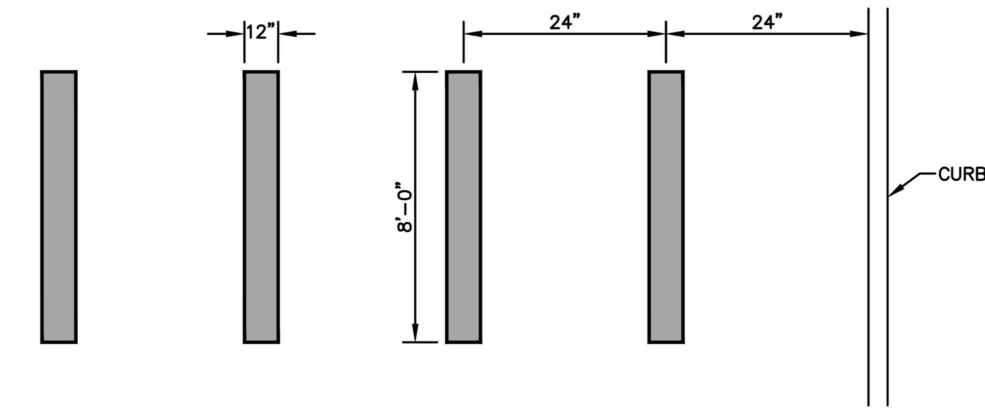


ACCESSIBLE CURB RAMP TYPE 'B' – SINGLE DIRECTION WITH LEVEL ENTRANCE

SCALE: NONE

CURB TRANSITION LENGTH FOR WHEELCHAIR RAMPS	
ROADWAY PROFILE GRADE (%)	TRANSITION LENGTH ROUNDED TO THE NEAREST 4"
0 OR LOW SIDE	6'–6"
>0 – 1	7'–8"
>1 – 2	9'–0"
>2 – 3	11'–0"
>3 – 4	14'–0"
>4	15'–0" (MAX)

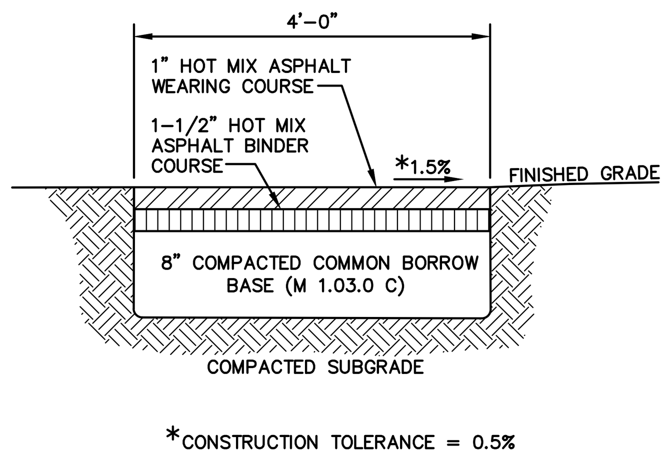
NOTES:
1. SLOPE TOLERANCE FOR RAMP AND SIDEWALK CONSTRUCTION = ± 0.50%
2. THE MAX. ALLOWABLE SLOPE OF ACCESSIBLE ROUTE EXCLUDING CURB RAMPS SHALL BE 5%.
3. THE MAX. ALLOWABLE SLOPE OF ACCESSIBLE ROUTE CURB RAMPS SHALL BE 7.5%
4. A MINIMUM OF 3 FEET CLEAR SHALL BE MAINTAINED AT ANY PERMANENT OBSTACLE IN ACCESSIBLE ROUTE (I.E. HYDRANTS, UTILITY POLES, TREE WELLS, SIGNS, ETC.).
5. BASE OF RAMP SHALL BE GRADED TO PREVENT PONDING.



NOTES:
1. ALL TWELVE INCH (12") LINES SHALL BE APPLIED IN ONE APPLICATION, NO COMBINATION OF LINES (TWO – 6 INCH LINES) WILL BE ACCEPTED.
2. ALL PAVEMENT MARKING MATERIALS WHETHER THERMOPLASTIC OR WATERBORNE PAINT TO BE REFLECTORIZED WITH GLASS BEADS.
3. LONGITUDINAL CROSSWALK LINES TO BE PARALLEL TO CURBLINE.
4. ALL LONGITUDINAL CROSSWALK LINES TO BE THE SAME LENGTH AND PROPERLY DRESSED.
5. STRIPES TO BE SOLID WHITE.

PEDESTRIAN CROSSWALK MARKINGS

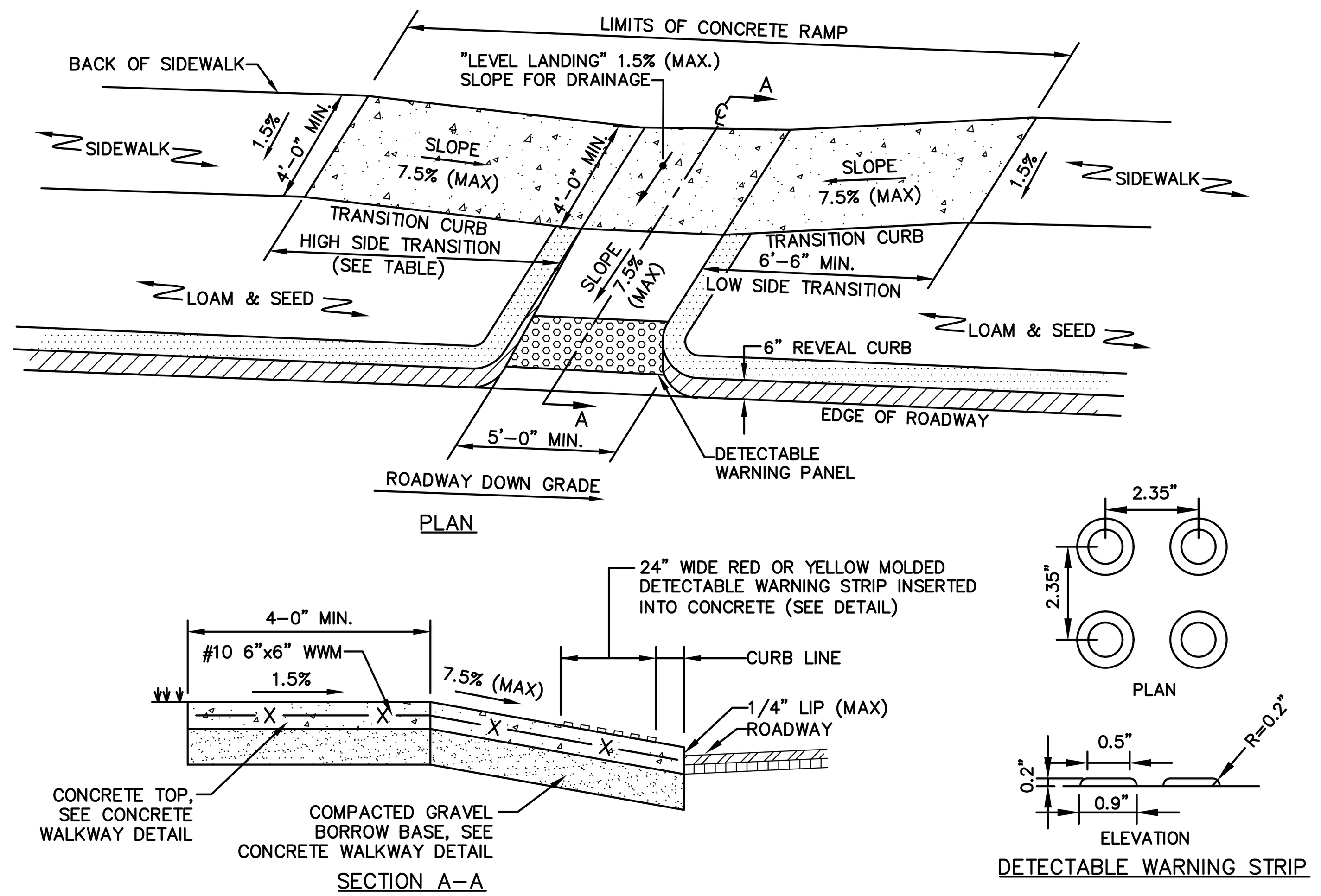
SCALE: NONE



*CONSTRUCTION TOLERANCE = 0.5%

HOT MIX ASPHALT WALKWAY

SCALE: NONE

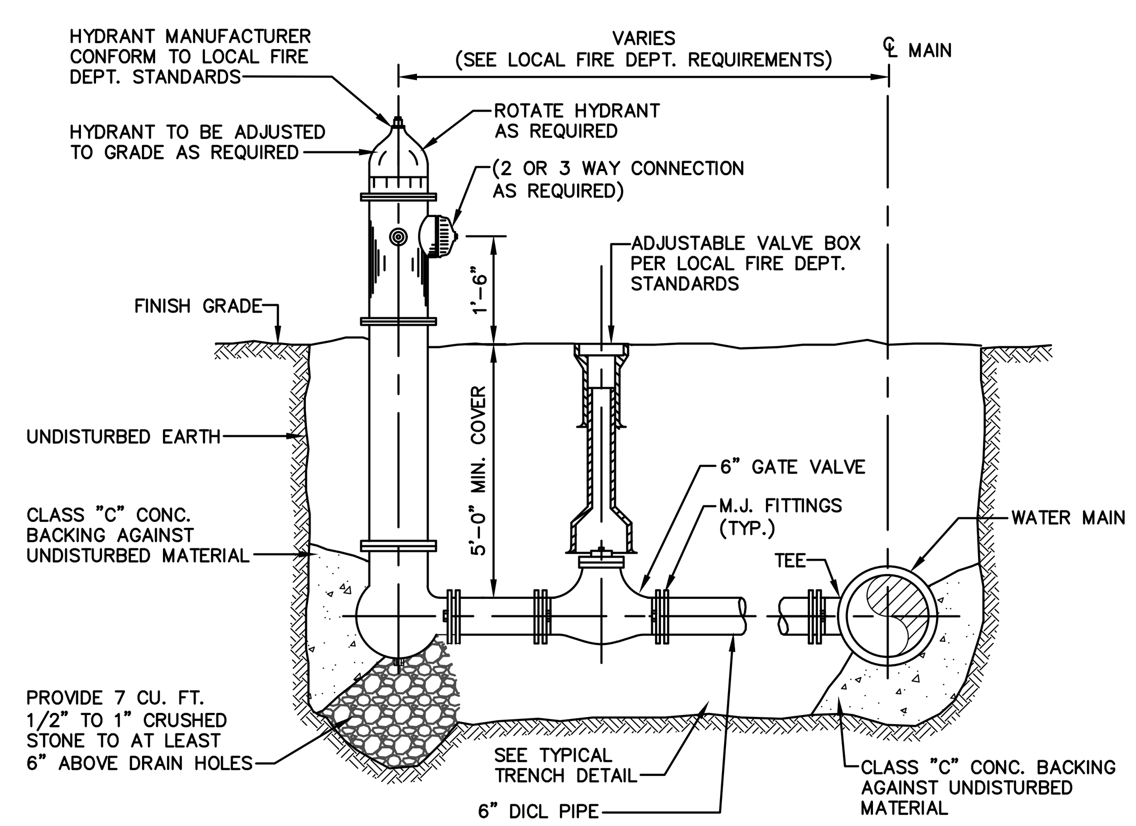


ACCESSIBLE CURB RAMP TYPE 'E' – PARALLEL PERPENDICULAR WITH LANDSCAPING STRIP

SCALE: NONE

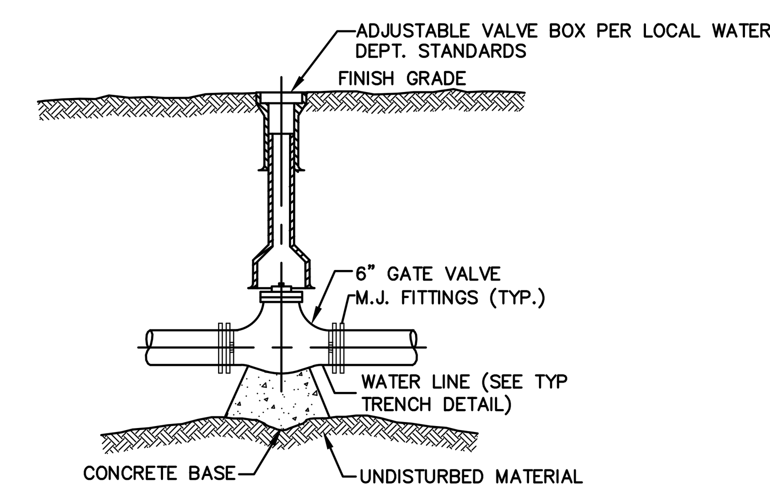
CURB TRANSITION LENGTH FOR WHEELCHAIR RAMPS	
ROADWAY PROFILE GRADE (%)	HIGH SIDE TRANSITION LENGTH ROUNDED TO THE NEAREST 4"
0 OR LOW SIDE	6'–6"
>0 – 1	7'–8"
>1 – 2	9'–0"
>2 – 3	11'–0"
>3 – 4	14'–0"
>4	15'–0" (MAX)

NOTES:
1. SLOPE TOLERANCE FOR RAMP AND SIDEWALK CONSTRUCTION = ± 0.50%
2. THE MAX. ALLOWABLE SLOPE OF ACCESSIBLE ROUTE EXCLUDING CURB RAMPS SHALL BE 5%.
3. THE MAX. ALLOWABLE SLOPE OF ACCESSIBLE ROUTE CURB RAMPS SHALL BE 7.5%
4. A MINIMUM OF 3 FEET CLEAR SHALL BE MAINTAINED AT ANY PERMANENT OBSTACLE IN ACCESSIBLE ROUTE (I.E. HYDRANTS, UTILITY POLES, TREE WELLS, SIGNS, ETC.).
5. BASE OF RAMP SHALL BE GRADED TO PREVENT PONDING.



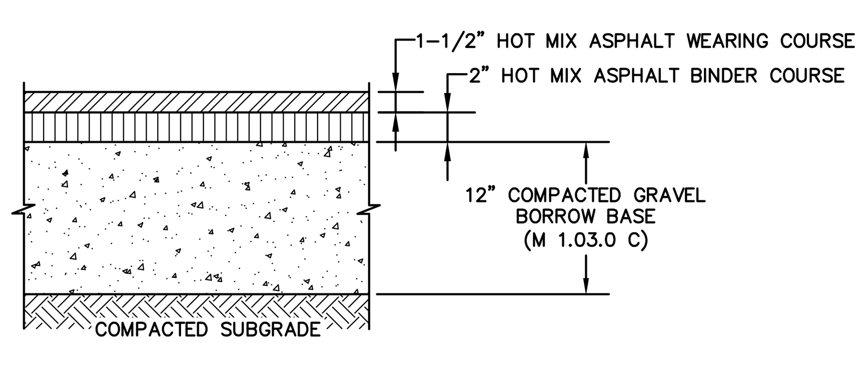
FIRE HYDRANT & VALVE

SCALE: NONE



GATE VALVE

SCALE: NONE

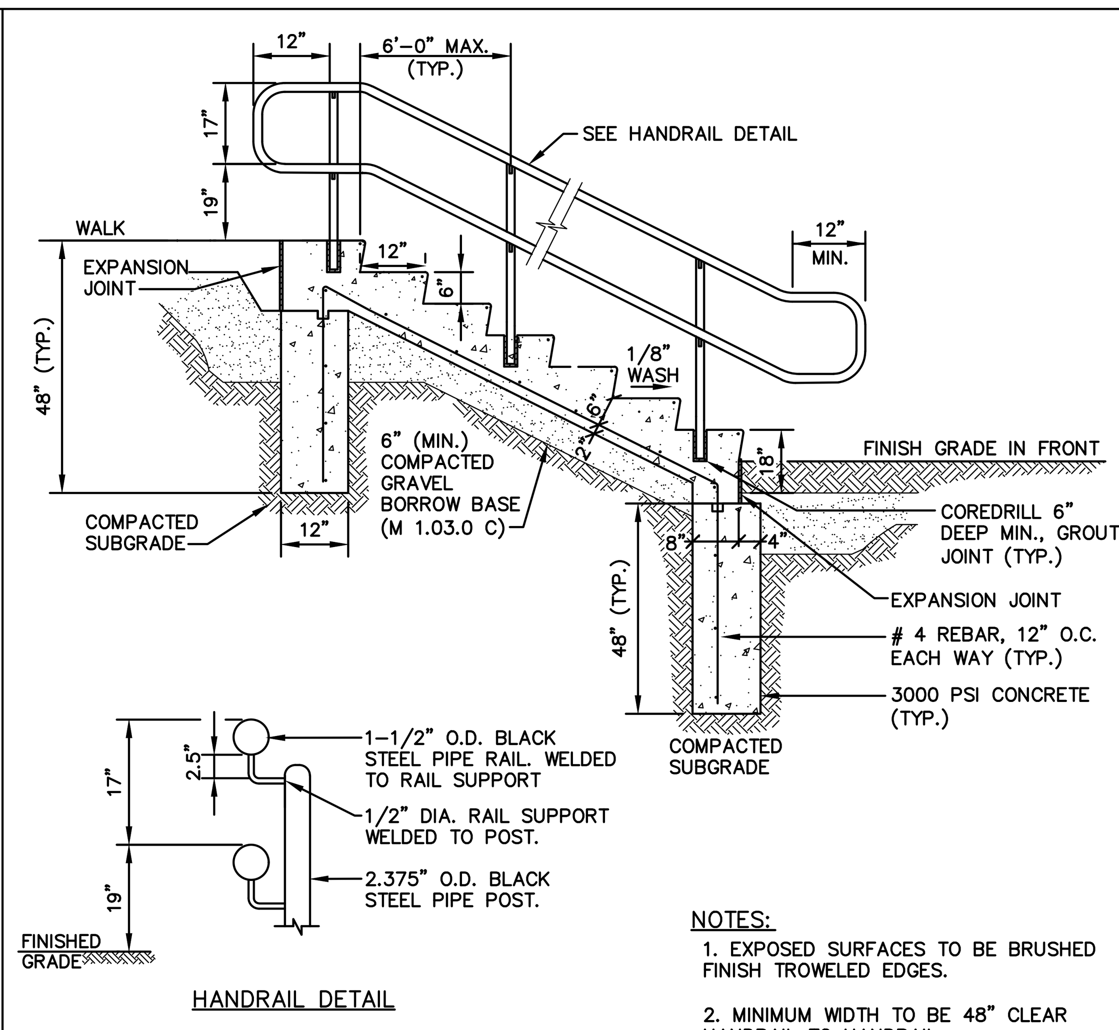


STANDARD DUTY FLEXIBLE PAVEMENT

NOTE:
PAVEMENT SECTIONS ARE SUBJECT TO CHANGE AND WILL BE BASED ON THE RESULTS OF GEOTECHNICAL INVESTIGATIONS

HOT MIX ASPHALT PAVEMENT SECTION

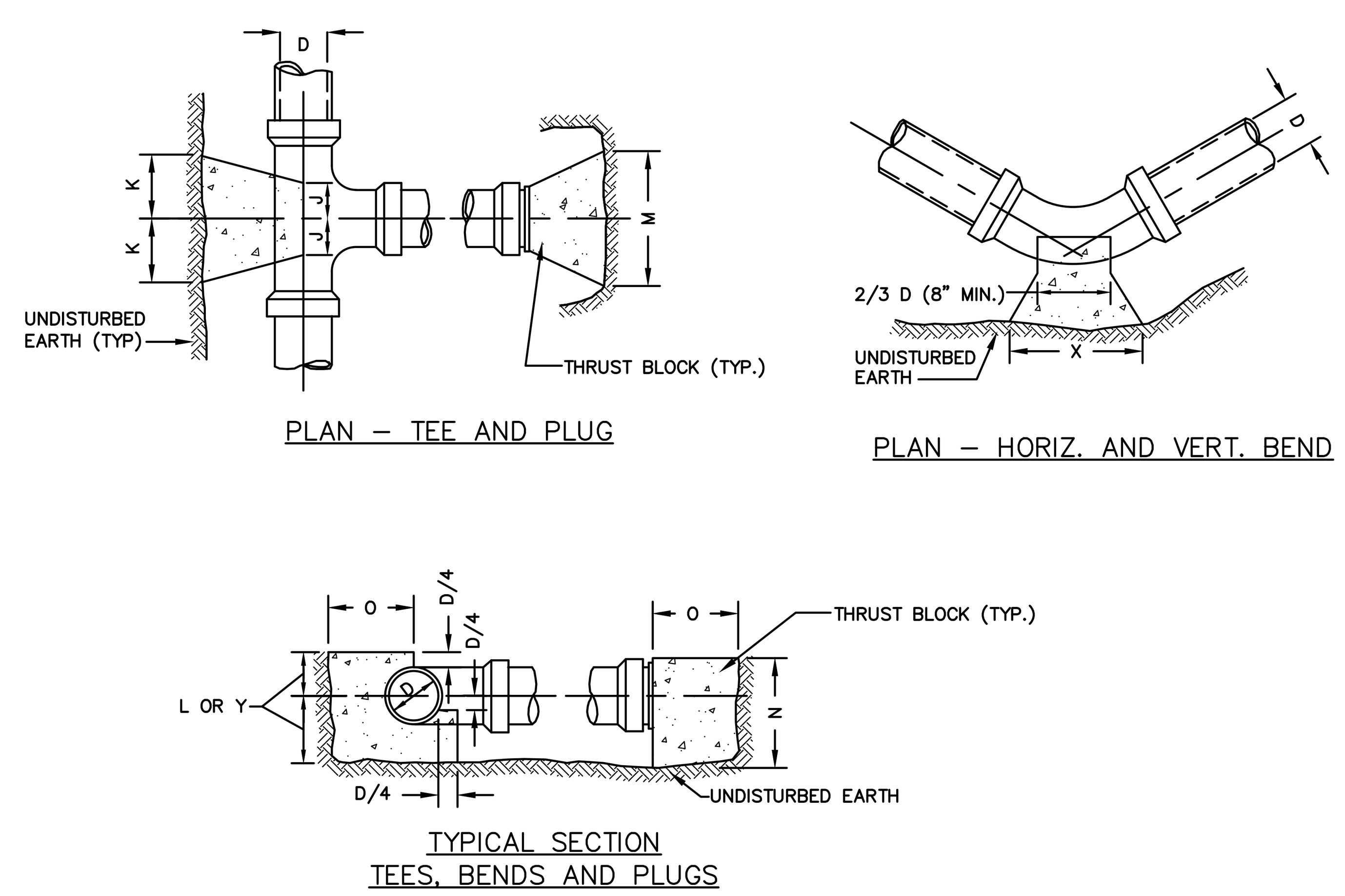
SCALE: NONE



NOTES:
1. EXPOSED SURFACES TO BE BRUSHED FINISH TROWELED EDGES.
2. MINIMUM WIDTH TO BE 48" CLEAR HANDRAIL TO HANDRAIL.

CONCRETE STAIRS

SCALE: NONE



SIZE OF BRANCH	J	K	L	M	N	O
4" THRU 8"	10"	10"	1'–0"	2'–0"	1'–6"	10"
10" THRU 16"	1'–0"	1'–6"	1'–8"	3'–10"	2'–10"	1'–6"
24"		1'–4"	2'–0"	2'–6"	5'–0"	3'–6"	1'–8"

TEES AND PLUGS

	90 & 45 BENDS			22 1/2 & 11 1/4		
D	4"TO8"	10"TO16"	24"	4"TO 8"	10"TO16"	24"
X	1'–8"	3'–4"	3'–6"	1'–4"	2'–0"	3'–6"
Y	1'–2"	1'–8"	2'–4"	1'–0"	1'–2"	2'–4"

BENDS

NOTES:
1. PROVIDE 3000 PSI CONCRETE THRUST BLOCKS AT ALL BENDS, DEAD ENDS, & TEES UNLESS OTHERWISE DIRECTED. CONCRETE FOR ALL THRUST BLOCKS TO BE PLACED AGAINST FIRM, UNDISTURBED SOIL. PROVIDE APPROVED ANCHOR HARNESS RODS & SOCKET CLAMPS AS SPECIFIED & IN ACCORDANCE WITH PIPE MANUFACTURERS RECOMMENDATIONS WHERE SOIL HAS BEEN DISTURBED OR THRUST BLOCKS CANNOT BE USED, AS DIRECTED BY THE ENGINEER.
2. ALL SOCKET CLAMP METAL SHALL BE COATED WITH BLACK ASPHALTUM OR OTHER WATER DEPARTMENT APPROVED COATINGS.
3. CONCRETE THRUST BLOCKS POURED BEHIND 3-WAY TEE & HYDRANT SHOE TO BE USED WITH SOCKET CLAMPS.
4. NO CONCRETE SHALL COVER PIPE JOINTS, FITTING JOINTS, BOLTS OR HYDRANT DRAINS.

CONCRETE THRUST BLOCK FOR PRESSURE PIPE

SCALE: NONE

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

PROFESSIONAL ENGINEER

THORNDIKE PLACE NOTICE OF INTENT

DOROTHY ROAD
IN
ARLINGTON MASSACHUSETTS
(MIDDLESEX COUNTY)

CIVIL & LANDSCAPE DETAILS

SEPTEMBER 6, 2023

REVISIONS:

NO.	DATE	DESC.
1	9/12/24	INFILTRATION SYSTEM
2	12/10/24	PEER REVIEW REVISIONS

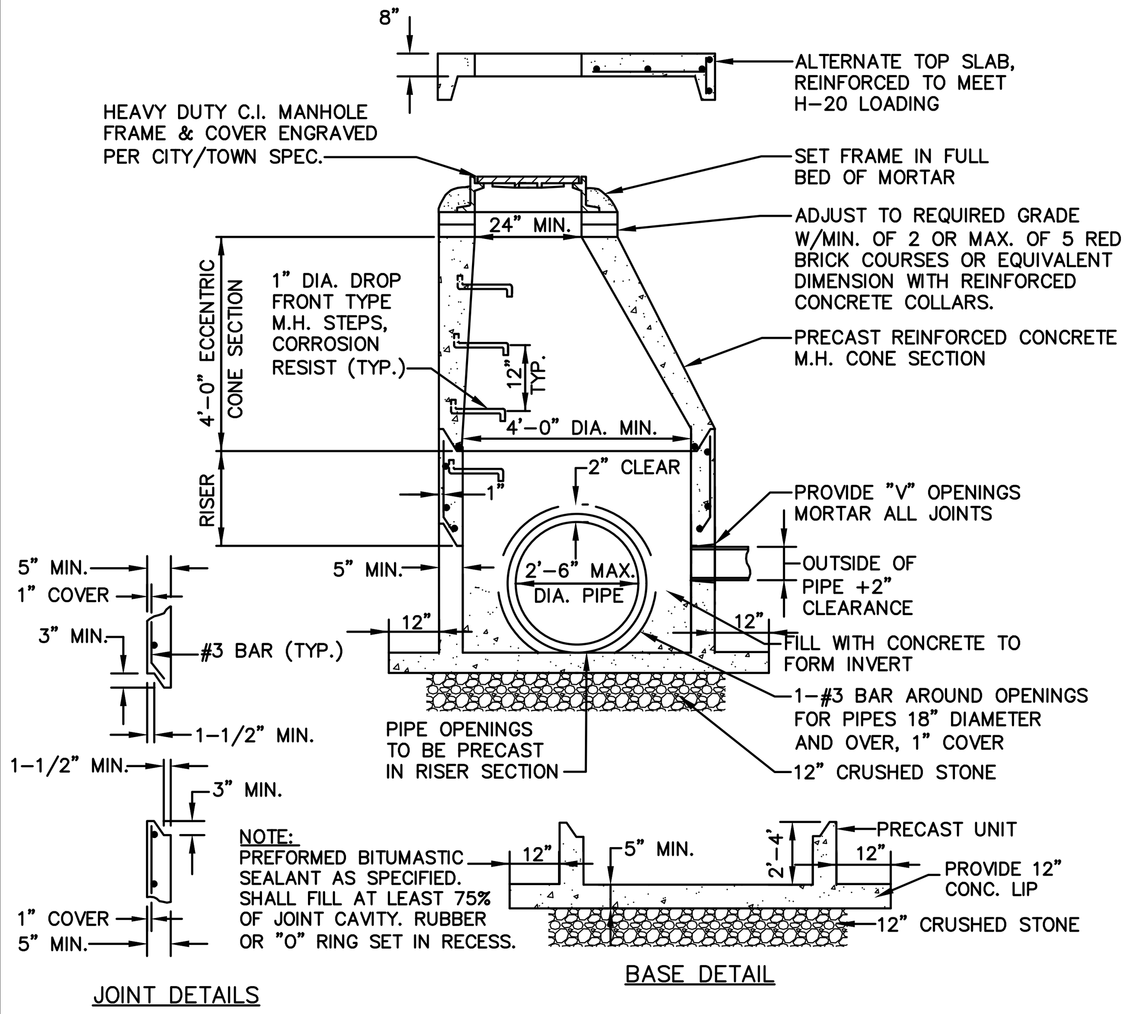
PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

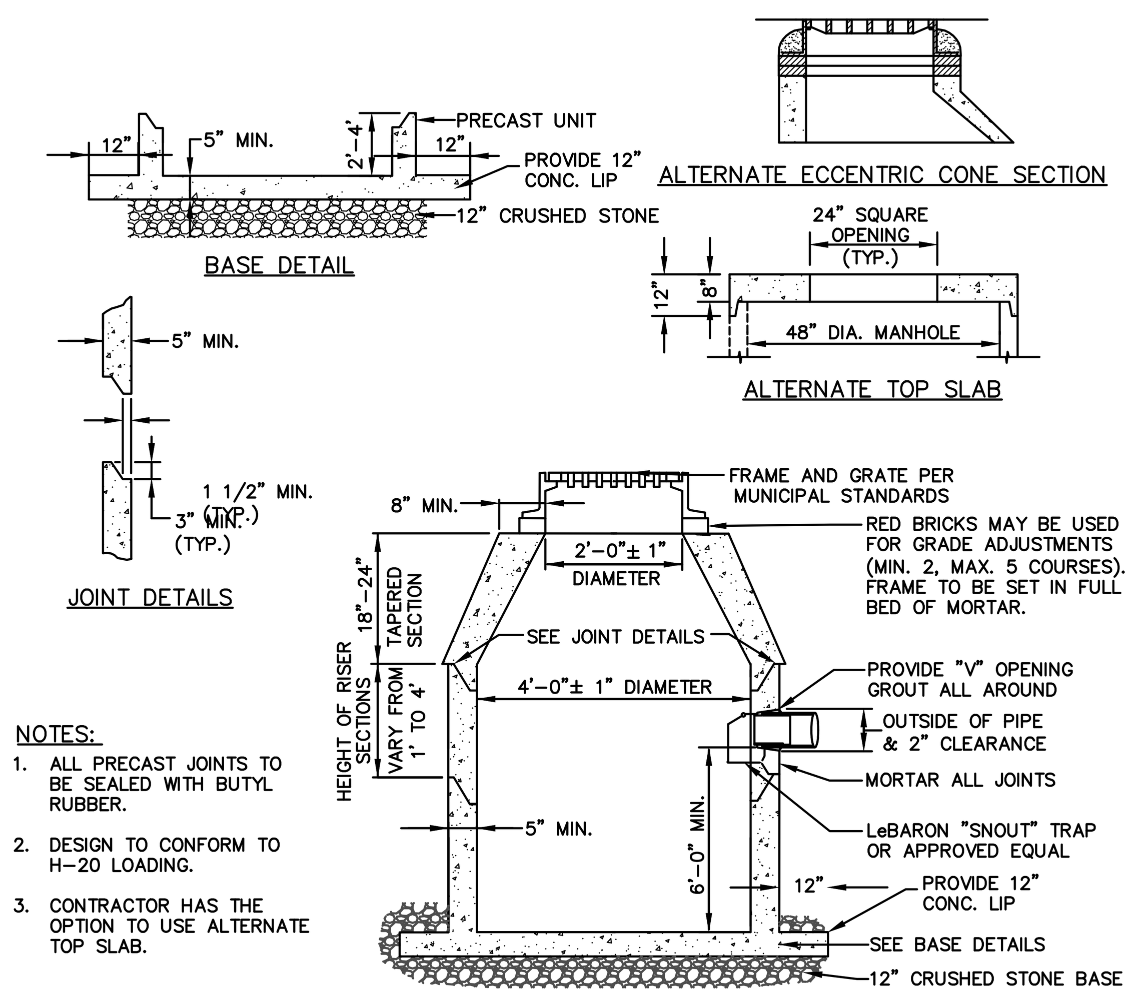
SCALE: AS NOTED

FEET

FILE: 2340702\C\D\2340702–DET
DWG.:
JOB. NO: 23407.02
SHEET C–201



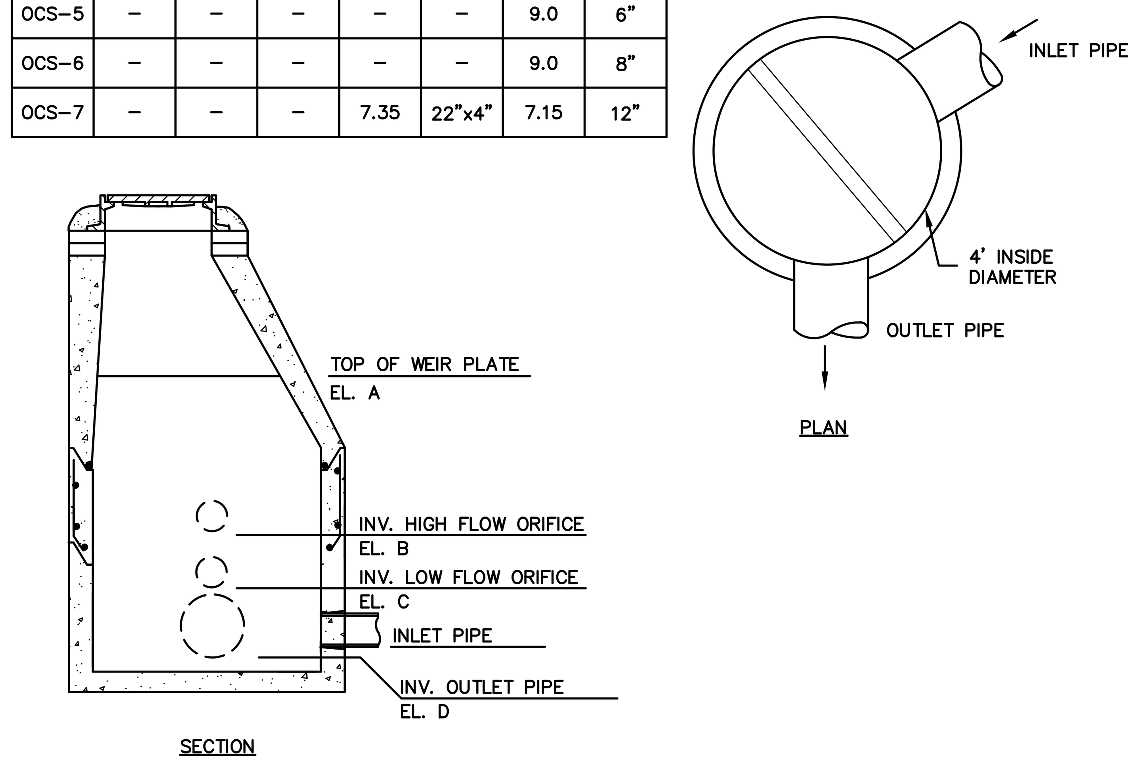
PRECAST CONCRETE DRAIN MANHOLE
SCALE: NONE



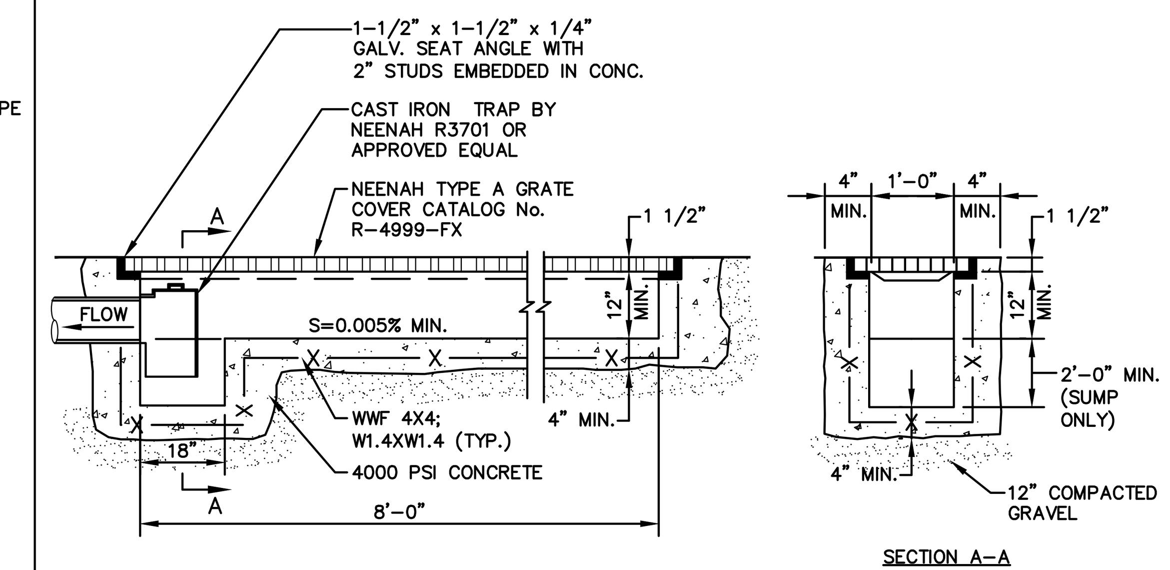
NOTES:
1. ALL PRECAST JOINTS TO BE SEALED WITH BUTYL RUBBER.
2. DESIGN TO CONFORM TO H-20 LOADING.
3. CONTRACTOR HAS THE OPTION TO USE ALTERNATE TOP SLAB.

PRECAST CONCRETE CATCH BASIN
SCALE: NONE

NO.	EL. A	EL. B	WxH B	EL. C	WxH C	EL. D	DIA. D
OCS-1	10.79	10.05	20"x4"	9.22	22"x4"	8.00	15"
OCS-2	–	–	–	–	–	9.23	6"
OCS-3	–	–	–	–	–	9.37	6"
OCS-4	–	–	–	–	–	9.37	6"
OCS-5	–	–	–	–	–	9.0	6"
OCS-6	–	–	–	–	–	9.0	8"
OCS-7	–	–	–	7.35	22"x4"	7.15	12"

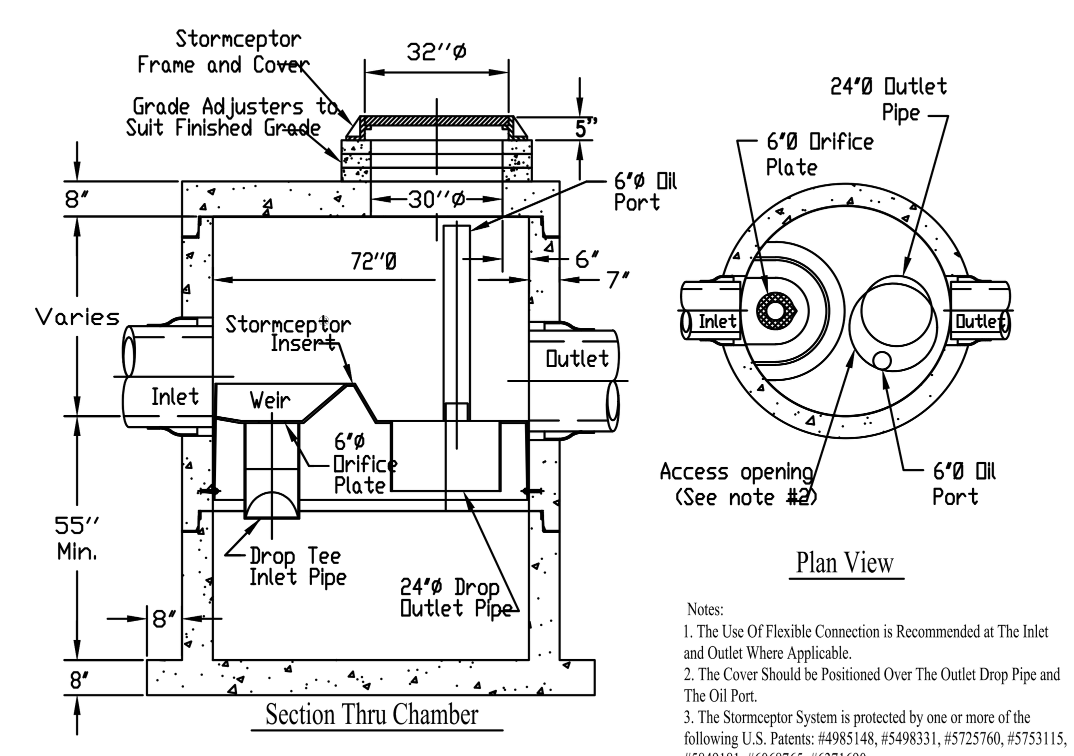


OUTLET CONTROL STRUCTURE (OCS)
SCALE: NONE



CAST IN PLACE CONCRETE TRENCH DRAIN
SCALE: NONE

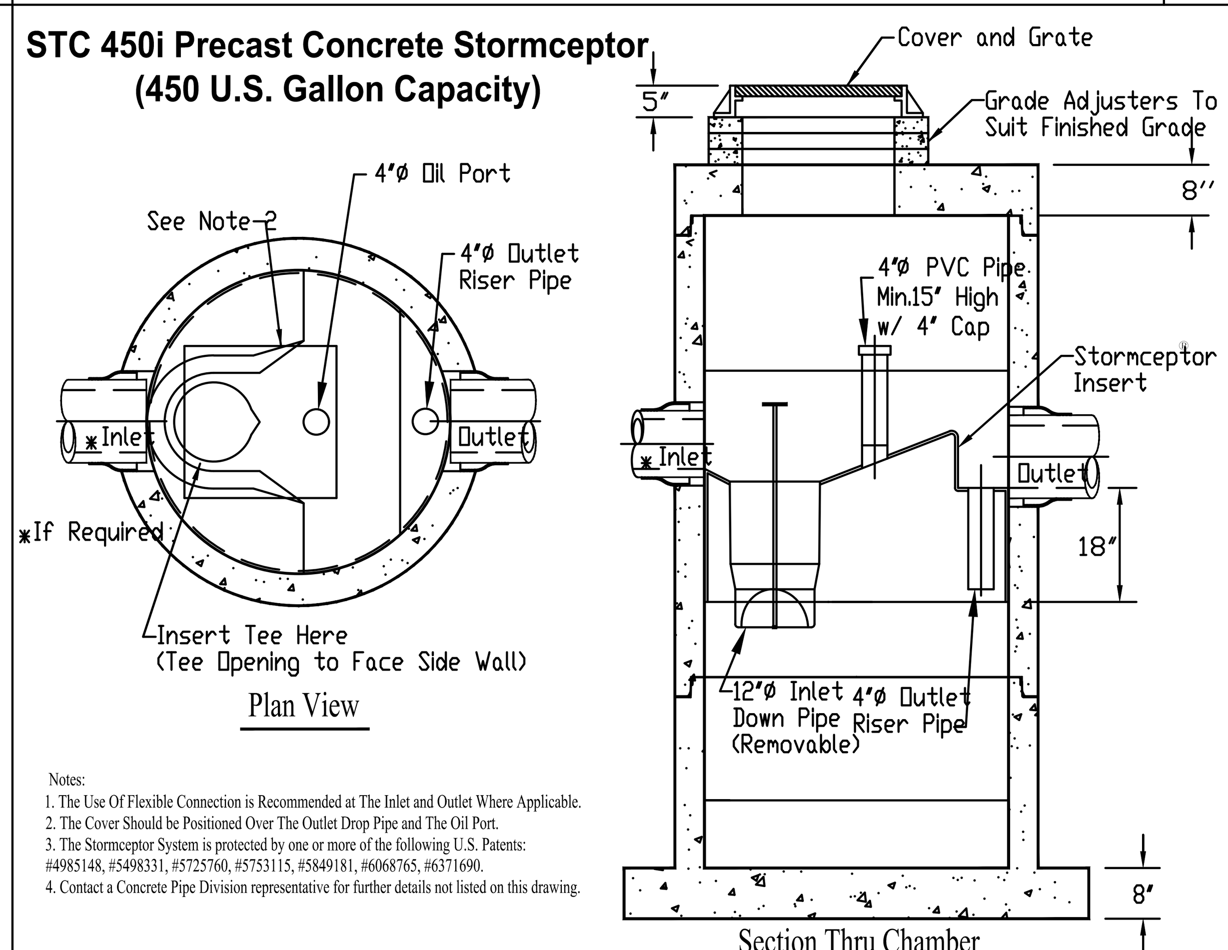
STC 900 Precast Concrete Stormceptor
(900 U.S. Gallon Capacity)



Notes:
1. The Use Of Flexible Connection is Recommended at The Inlet and Outlet Where Applicable.
2. The Cover Should be Positioned Over The Outlet Drop Pipe and The Oil Port.
3. The Stormceptor System is protected by one or more of the following U.S. Patents: #4985148, #5498331, #5725760, #5753115, #5849181, #6068765, #6371690.
4. Contact a Concrete Pipe Division representative for further details not listed on this drawing.

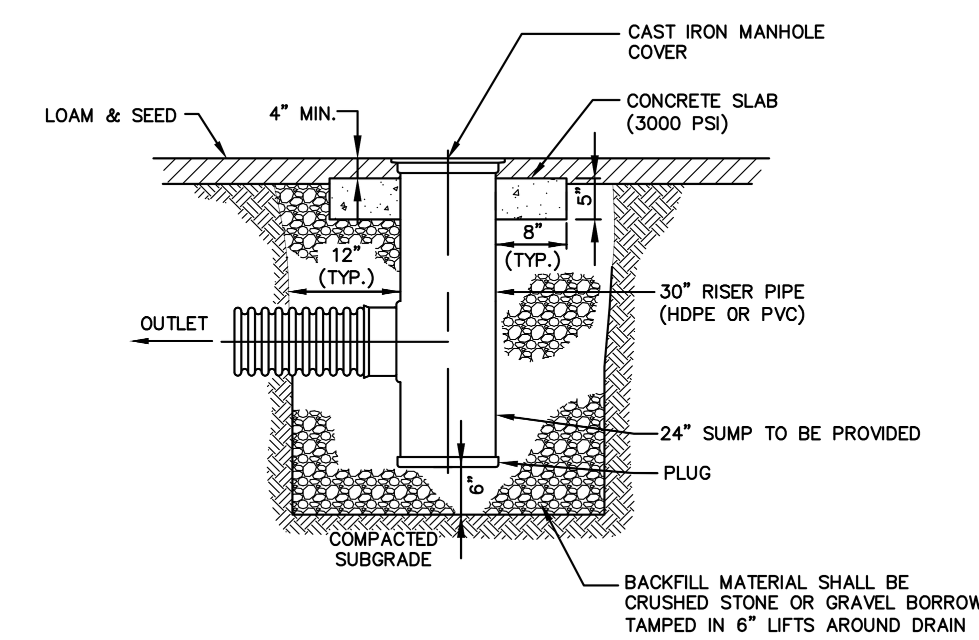
WATER QUALITY UNIT (STORMCEPTOR OR APPROVED EQUAL)
SCALE: NONE

STC 450i Precast Concrete Stormceptor
(450 U.S. Gallon Capacity)

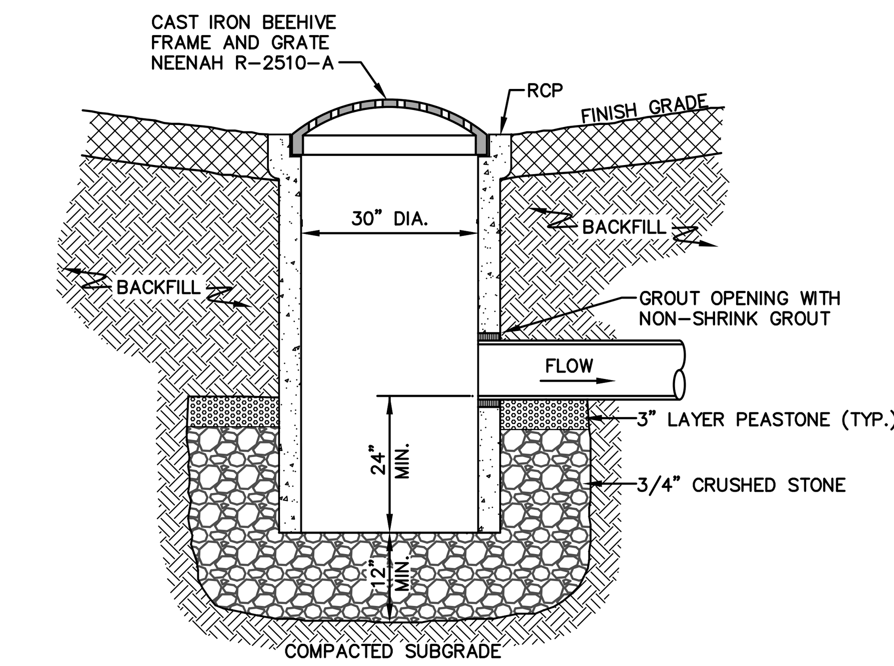


Notes:
1. The Use Of Flexible Connection is Recommended at The Inlet and Outlet Where Applicable.
2. The Cover Should be Positioned Over The Outlet Drop Pipe and The Oil Port.
3. The Stormceptor System is protected by one or more of the following U.S. Patents: #4985148, #5498331, #5725760, #5753115, #5849181, #6068765, #6371690.
4. Contact a Concrete Pipe Division representative for further details not listed on this drawing.

WATER QUALITY CATCH BASIN (STORMCEPTOR 450i OR APPROVED EQUAL)
SCALE: NONE



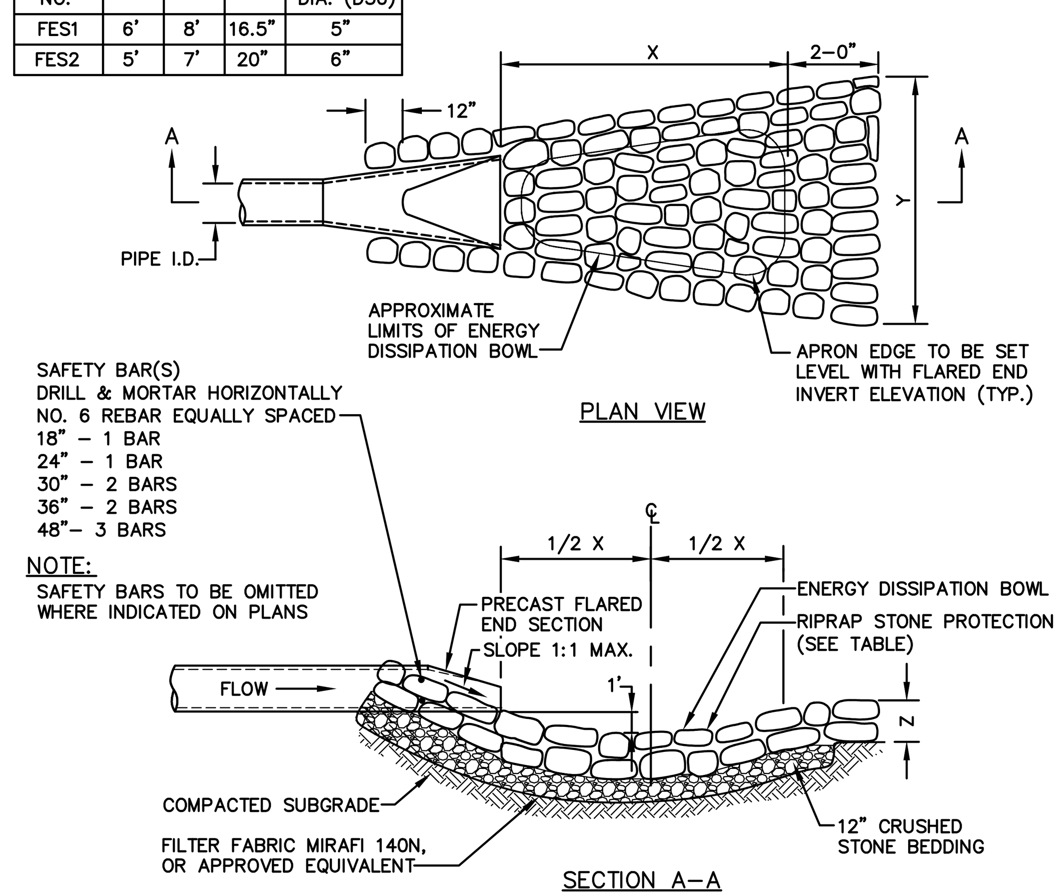
SUMP MANHOLE FROM TRENCH DRAINS
SCALE: NONE



NOTE:
MAXIMUM DEPTH TO BE EQUAL TO ONE 8-FOOT PIPE SECTION

AREA DRAIN
SCALE: NONE

OUTLET NO.	X	Y	Z	STONE DIA. (D50)
FES1	6'	8'	16.5"	5"
FES2	5'	7'	20"	6"



FLARED END SECTION W/ STONE PROTECTION (DISSIPATION BOWL)
SCALE: NONE

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

PROFESSIONAL ENGINEER

THORNDIKE PLACE
NOTICE OF INTENT

DOROTHY ROAD
IN
ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

CIVIL & LANDSCAPE DETAILS

SEPTEMBER 6, 2023

REVISIONS:

NO.	DATE	DESC.
1	9/12/24	INFILTRATION SYSTEM
2	12/10/24	PEER REVIEW REVISIONS

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA

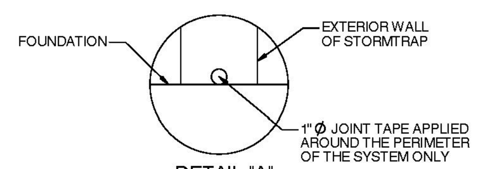
BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: AS NOTED
FEET

FILE: 2340702\C\D\2340702-DET
DWG.:
JOB. NO: 23407.02
SHEET C-202

STORMTRAP INSTALLATION SPECIFICATION

1. STORMTRAP MODULES SHALL BE MANUFACTURED ACCORDING TO SHOP DRAWINGS APPROVED BY THE INSTALLING CONTRACTOR AND ENGINEER. THE SHOP DRAWINGS SHALL INDICATE SIZE AND LOCATION OF ROOF OPENINGS AND INLET/ OUTLET PIPE OPENINGS.
2. STORMTRAP SHALL BE INSTALLED IN ACCORDANCE WITH ASTM C891-09, STANDARD PRACTICE FOR INSTALLATION OF UNDERGROUND PRE-CAST CONCRETE UTILITY STRUCTURES. THE FOLLOWING ADDITIONS AND/OR EXCEPTIONS SHALL APPLY:
   A. SPECIFICATIONS ON THE ENGINEER'S DRAWINGS SHALL TAKE PRECEDENCE.
   B. STORMTRAP MODULES SHALL BE PLACED ON LEVEL FOUNDATION (SEE SHEET 3.1) WITH A 1'-0" OVERHANG ON ALL SIDES THAT SHALL BE POURED IN PLACE BY INSTALLING CONTRACTOR.
   C. THE STORMTRAP MODULES SHALL BE PLACED SUCH THAT THE MAXIMUM SPACE BETWEEN ADJACENT MODULES DOES NOT EXCEED 3/4". IF THE SPACE EXCEEDS 3/4", THE MODULES SHALL BE RESET WITH APPROPRIATE ADJUSTMENT MADE TO LINE AND GRADE TO BRING THE SPACE INTO SPECIFICATION.
   D. THE PERIMETER HORIZONTAL JOINT OF THE STORMTRAP MODULES SHALL BE SEALED TO THE FOUNDATION WITH PREFORMED MASTIC JOINT SEALER ACCORDING TO ASTM C891-09, 8.8 AND 8.12. SEE DETAIL "A".
   E. ALL EXTERIOR JOINTS BETWEEN ADJACENT STORMTRAP MODULES SHALL BE SEALED WITH PRE-FORMED, COLD-APPLIED, SELF-ADHERING ELASTOMERIC RESIN BONDED TO A WOVEN HIGHLY PUNCTURE RESISTANT POLYMER WRAP CONFORMING TO ASTM C891-09 AND SHALL BE 0'-8" INTEGRATED PRIMER SEALANT AS APPROVED BY STORMTRAP. THE ADHESIVE EXTERIOR JOINT WRAP SHALL BE INSTALLED ACCORDING TO THE FOLLOWING INSTALLATION INSTRUCTIONS:
      1. USE A BRUSH OR WET CLOTH TO THOROUGHLY CLEAN THE OUTSIDE SURFACE AT THE POINT WHERE THE JOINT WRAP IS TO BE APPLIED.
      2. A RELEASE PAPER PROTECTS THE ADHESIVE SIDE OF THE JOINT WRAP. PLACE THE ADHESIVE TAPE (BUTYL SIDE DOWN) AROUND THE STRUCTURE, REMOVING THE RELEASE PAPER AS YOU GO. PRESS THE JOINT WRAP FIRMLY AGAINST THE STORMTRAP MODULE SURFACE WHEN APPLYING.
   F. THE FILL PLACED AROUND THE STORMTRAP UNITS MUST BE DEPOSITED ON BOTH SIDES AT THE SAME TIME AND TO APPROXIMATELY THE SAME ELEVATION. AT NO TIME SHALL THE FILL BEHIND ONE SIDE WALL BE MORE THAN 2'-0" HIGHER THAN THE FILL ON THE OPPOSITE SIDE. BACKFILL SHALL BE COMPACTED TO 95% STANDARD PROCTOR DENSITY OR OTHERWISE SPECIFIED BY ENGINEER. CARE SHALL BE TAKEN TO PREVENT ANY WEDGING ACTION AGAINST THE STRUCTURE, AND ALL SLOPES BOUNDING OR WITHIN THE AREA TO BE BACKFILLED MUST BE STEPPED OR SERRATED TO PREVENT WEDGE ACTION. (REFERENCE ARTICLE 502.10 I.D.O.T. S.S.R.B.C.) CARE SHALL ALSO BE TAKEN AS NOT TO DISRUPT THE JOINT WRAP FROM THE JOINT DURING THE BACKFILL PROCESS. BACKFILL MATERIAL SHALL BE CLEAN, CRUSHED, ANGULAR No.5 (AASHTO M43) AGGREGATE.



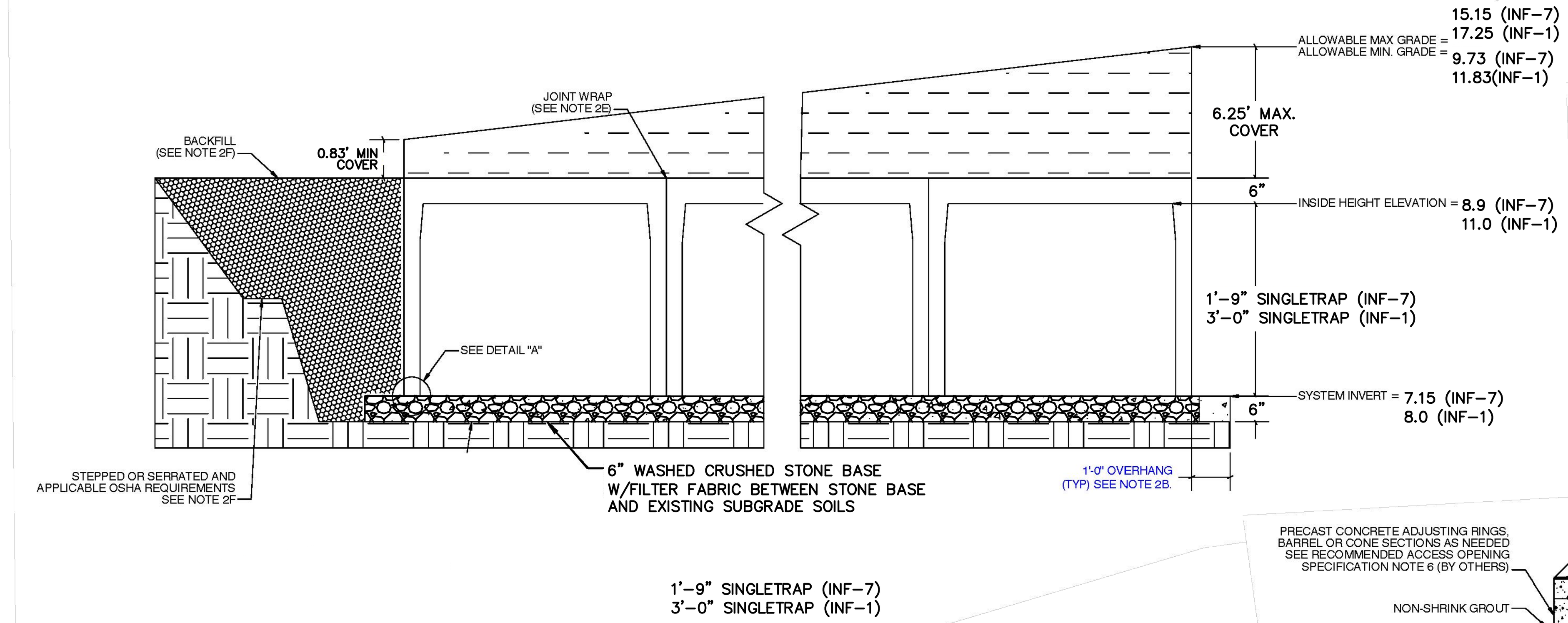
DETAIL "A"
JOINT TAPE INSTALLATION

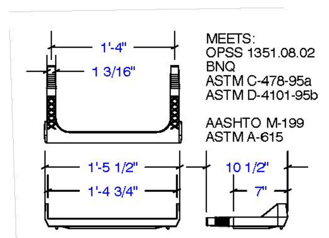
RECOMMENDED PIPE OPENING SPECIFICATION

1. PIPE OPENINGS SHALL MAINTAIN A MINIMUM 1'-0" OF CLEARANCE FROM A VERTICAL EDGE OF THE STORMTRAP UNIT.
2. MAXIMUM OPENING SIZE TO BE DETERMINED BY UNIT HEIGHT. PREFERRED OPENING SIZE Ø36" OR LESS. ANY OPENING NEEDED THAT DOES NOT FIT THIS CRITERIA SHALL BE BROUGHT TO THE ATTENTION OF STORMTRAP FOR REVIEW.
3. CONNECTING PIPES SHALL BE INSTALLED WITH A 1'-0" CONCRETE COLLAR, AND A AGGREGATE CRADLE FOR AT LEAST ONE PIPE LENGTH, AS SHOWN. A STRUCTURAL GRADE CONCRETE OR GROUT WITH A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 3000 PSI SHALL BE USED.
4. THE ANNULAR SPACE BETWEEN THE PIPE AND THE HOLE SHALL BE FILLED WITH NON-SHRINK GROUT.

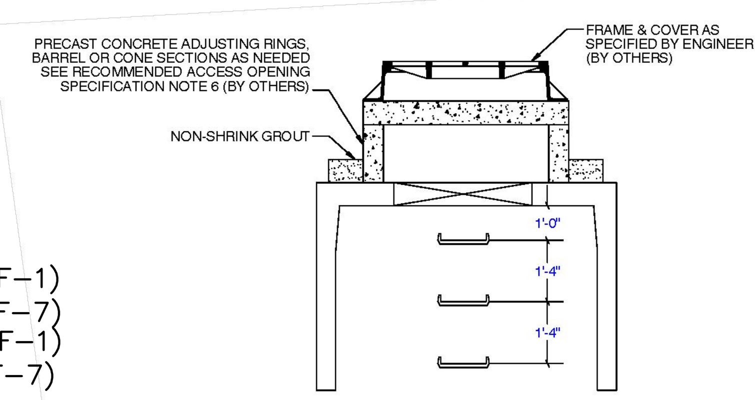
RECOMMENDED PIPE INSTALLATION INSTRUCTIONS

1. CLEAN AND LIGHTLY LUBRICATE ALL OF PIPE TO BE INSERTED INTO STORMTRAP.
2. IF PIPE IS CUT, CARE SHOULD BE TAKEN TO ALLOW NO SHARP EDGES. BEVEL AND LUBRICATE LEAD END OF PIPE.
3. ALIGN CENTER OF PIPE TO CORRECT ELEVATION AND INSERT INTO OPENING.

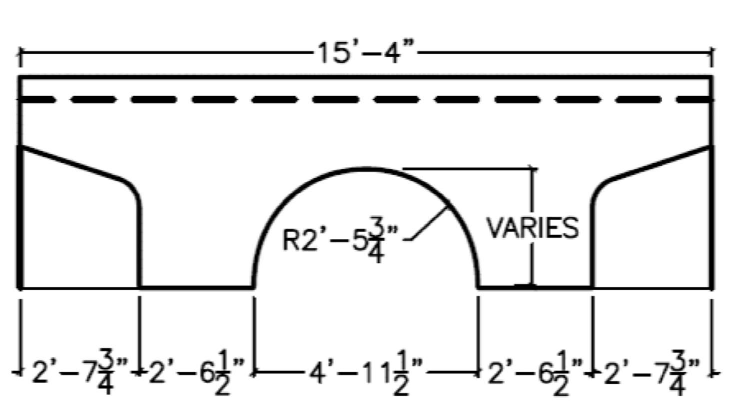


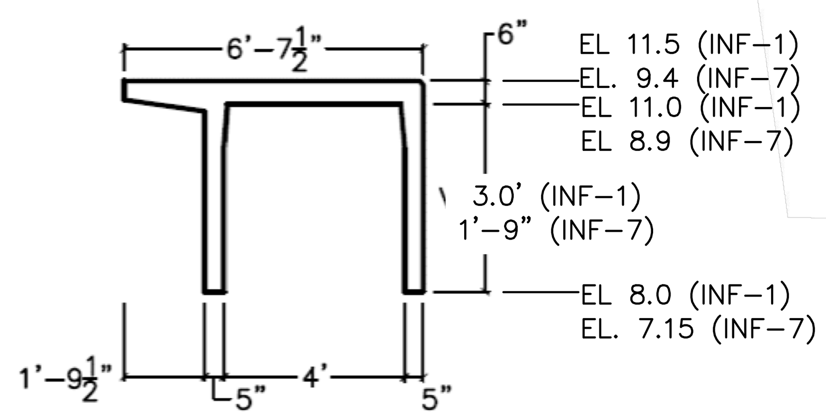


STEP DETAIL



RISER / STAIR DETAIL





STORMTRAP SINGLE TRAP (SECTION VIEW)

NOTE: ONE ACCESS TO BE PROVIDED ON EACH DUPLEX INFILTRATION SYSTEM. 7 TOTAL ACCESS RISERS TO BE PROVIDED ON MAIN INFILTRATION SYSTEM – ONE ON EACH UNIT WITH AN INLET OR OUTLET PIPE.

RECOMMENDED ACCESS OPENING SPECIFICATION

1. TYPICAL ACCESS OPENINGS FOR THE STORMTRAP SYSTEM ARE 2'-0" IN DIAMETER. ACCESS OPENINGS LARGER THAN 2'-0" IN DIAMETER NEED TO BE APPROVED BY STORMTRAP. ALL OPENINGS MUST RETAIN AT LEAST 1'-0" OF CLEARANCE IN ALL DIRECTIONS FROM THE EDGE OF THE STORMTRAP UNITS.
2. PLASTIC COATED STEEL STEPS PRODUCED BY M.A. INDUSTRIES PART #PS3-PFC (SEE DETAIL TO THE RIGHT) ARE PROVIDED INSIDE ANY UNIT WHERE DEEMED NECESSARY. THE HIGHEST STEP IN THE UNIT IS TO BE PLACED A DISTANCE OF 1'-0" FROM THE INSIDE EDGE OF THE STORMTRAP UNITS. ALL ENSUING STEPS SHALL BE PLACED WITH A MAXIMUM DISTANCE OF 1'-4" BETWEEN THEM. STEPS MAY BE MOVED OR ALTERED TO AVOID OPENINGS OR OTHER IRREGULARITIES IN THE UNIT.
3. STORMTRAP LIFTING INSERTS MAY BE RELOCATED TO COINCIDE WITH THE ACCESS OPENING OR THE CENTER OF GRAVITY OF THE UNIT AS NEEDED.
4. STORMTRAP ACCESS OPENINGS MAY BE RELOCATED TO AVOID INTERFERENCE WITH INLET AND/OR OUTLET PIPE OPENINGS SO PLACEMENT OF STEPS IS ATTAINABLE.
5. ACCESS OPENINGS SHOULD BE LOCATED IN ORDER MEET THE APPROPRIATE MUNICIPAL REQUIREMENTS. STORMTRAP RECOMMENDS AT LEAST ONE ACCESS OPENING PER SYSTEM FOR ACCESS AND INSPECTION.
6. USE PRECAST ADJUSTING RINGS AS NEEDED TO MEET GRADE. STORMTRAP RECOMMENDS FOR COVER OVER 2' TO USE PRECAST BARREL OR CONE SECTIONS. (BY OTHERS)

UNDERGROUND INFILTRATION (STORMTRAP SINGLE TRAP OR APPROVED EQUAL)

SCALE: NONE

NOTES:

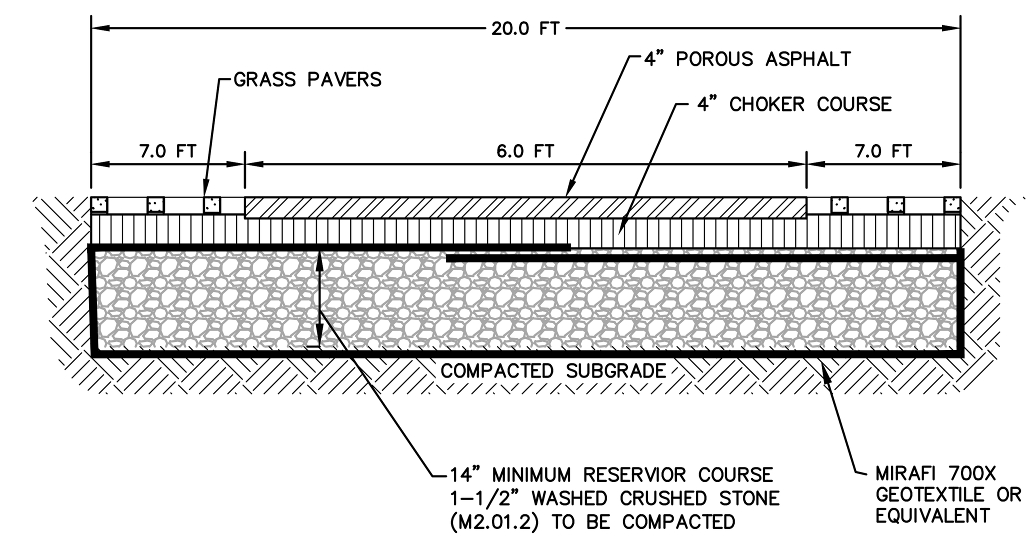
1. POROUS ASPHALT AND CHOCKER COURSES SHALL MEET THE FOLLOWING REQUIREMENTS:

4" POROUS ASPHALT –
SHALL BE POST-BLENDED PG 64-28 SBR WITH 5 POUNDS OF FIBER PER TON OF ASPHALT MIX.

- 3/4" = 100%
- 1/2" = 85–100%
- 3/8" = 55–75%
- #4 = 10–25%
- #8 = 5–10%
- #200 = 2–4%
- AIR VOID CONTENT = 16–22%

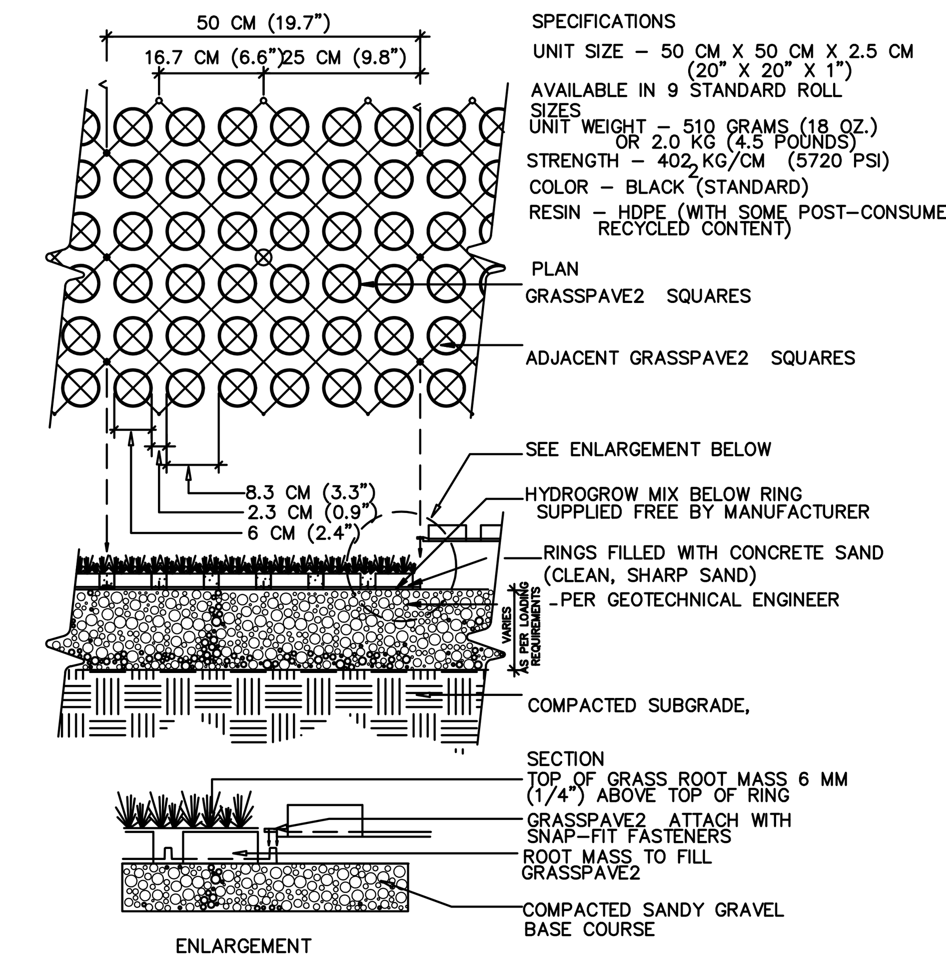
4" CHOKER COURSE SHALL MEET THE FOLLOWING GRADUATION REQUIREMENTS:

- 1-1/2" = 100%
- 1" = 95–100%
- 1/2" = 25–60%
- #4 = 0–10%
- #8 = 0–5%
- 95% COMPACTION



EMERGENCY ACCESS ROAD

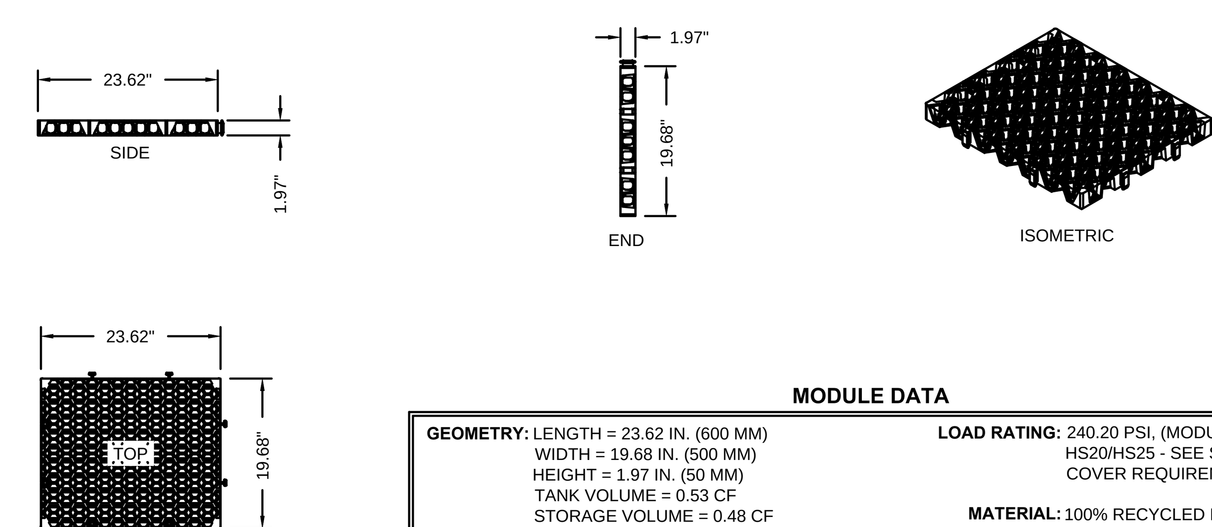
SCALE: NONE



NOTE: SEE LANDSCAPE PLANS FOR PLANT MIX

GRASSPAVE (OR APPROVED EQUAL)

SCALE: NONE



MODULE DATA

GEOMETRY: LENGTH = 23.62 IN. (600 MM) WIDTH = 19.68 IN. (500 MM) HEIGHT = 1.97 IN. (50 MM) TANK VOLUME = 0.53 CF STORAGE VOLUME = 0.48 CF VOID INTERNAL VOLUME: 90% VOID SURFACE AREA: 90%	**LOAD RATING:** 240.20 PSI, (MODULE ONLY) HS20/HS25 - SEE SPEC FOR COVER REQUIREMENTS **MATERIAL:** 100% RECYCLED POLYPROPYLENE **MAXIMUM STACK HEIGHT:** 60 PANELS

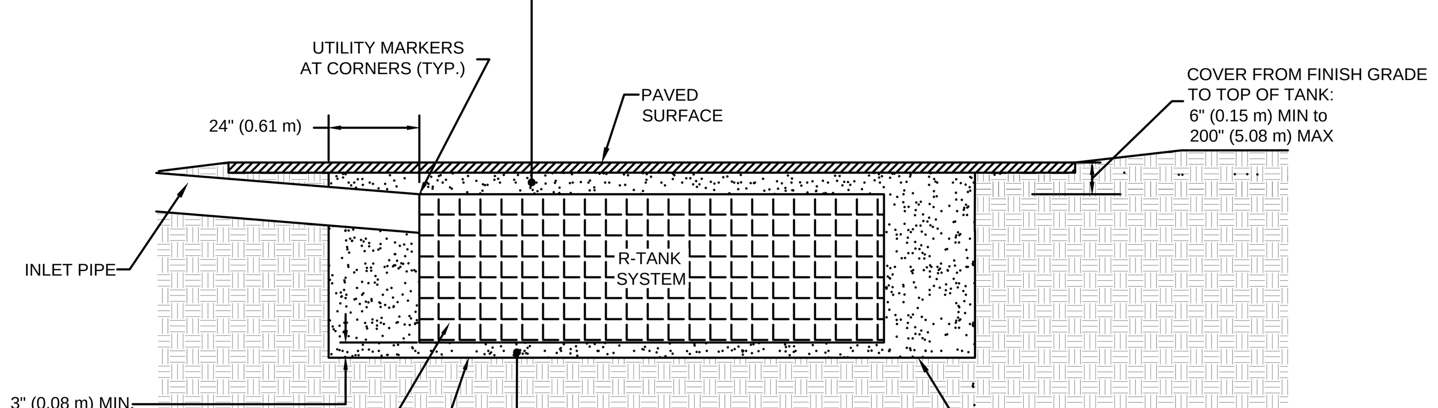
06/10/2022

R–TANK^XD PANEL

SCALE: NONE

TOTAL COVER: 6" MINIMUM AND 200" MAXIMUM. INITIAL COVER UP TO 12" MUST BE FREE DRAINING BACKFILL (SPEC SECTION 2.03B): STONE <1.5" OR SOIL (USCS CLASS GW, GP, SW OR SP). ADDITIONAL FILL MAY BE STRUCTURAL FILL (SPEC SECTION 2.03C): STONE OR SOIL (USCS CLASS SM, SP, SW, GM, GP OR GW) WITH MAX CLAY CONTENT<10%, MAX 25% PASSING NO. 200 SIEVE, AND MAX PLASTICITY INDEX OF 4. CONTACT FERGUSON WATERWORKS IF MORE THAN 200" OR LESS THAN 6" OF TOP BACKFILL IS REQUIRED (FROM TOP OF TANK TO TOP OF PAVEMENT).

NOTES:
1. FOR COMPLETE MODULE DATA, SEE APPROPRIATE R-TANKXD MODULE SHEET .
2. INSTALLATIONS PER THIS DETAIL MEET GUIDELINES OF HL-93 LOADING PER THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, CUSTOMARY U.S. UNITS, 7TH EDITION, 2014 WITH 2015 AND 2016 INTERIM REVISIONS.
3. PRE-TREATMENT STRUCTURES NOT SHOWN.
4. FOR INFILTRATION APPLICATIONS, GEOTEXTILE ENVELOPING R-TANK SHALL BE ACF M200 (PER SPEC SECTION 2.02A) AND BASE SHALL BE 4" MIN. UNCOMPACTED FREE DRAINING BACKFILL (SPEC SECTION 2.03A) TO PROVIDE A LEVEL BASE. SURFACE MUST BE SMOOTH, FREE OF LUMPS OR DEBRIS, AND EXTEND 2' BEYOND R-TANKXD FOOTPRINT.



R-TANKXD UNITS WRAPPED WITH 8 OZ. NON-WOVEN GEOTEXTILE (OR EQUAL) LOADING RATING: 240.2 PSI (MODULE ONLY)

SUBGRADE / EXCAVATION LINE: COMPACT PER SPEC SECTION 3.02 D. A BEARING CAPACITY OF 2,000 PSF MUST BE ACHIEVED PRIOR TO INSTALLING R-TANKXD (GEOTEXTILE OR IMPERMEABLE LINER OPTIONAL)

BASE: 3" MIN. FREE DRAINING BACKFILL (SPEC SECTION 2.03B) COMPACTED TO 95% STANDARD PROCTOR DENSITY IS REQUIRED TO PROVIDE A LEVEL BASE SURFACE. MUST BE SMOOTH, FREE OF LUMPS OR DEBRIS, AND EXTEND 2' BEYOND R-TANKXD FOOTPRINT. NATIVE SOILS MAY BE ACCEPTABLE IF DETERMINED TO BE STABLE BY OWNER'S ENGINEER.

SIDE BACKFILL: 24" MIN. OF FREE DRAINING BACKFILL (SPEC SECTION 2.03B): STONE <1.5" OR SOIL (USCS CLASS GW, GP, SW OR SP). MUST BE FREE FROM LUMPS, DEBRIS AND OTHER SHARP OBJECTS. SPREAD EVENLY TO PREVENT R-TANKXD MOVEMENT. COMPACT SIDE BACKFILL WITH POWERED MECHANICAL COMPACTOR IN 12" LIFTS.

R–TANK^XD HS20–25 LOADS – SECTION VIEW

SCALE: NONE

ISSUED FOR PERMITTING
NOT FOR CONSTRUCTION

PROFESSIONAL ENGINEER

THORNDIKE PLACE NOTICE OF INTENT

DOROTHY ROAD
IN
ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

CIVIL & LANDSCAPE DETAILS

SEPTEMBER 6, 2023

REVISIONS:

NO.	DATE	DESC.
1	9/12/24	INFILTRATION SYSTEM
2	12/10/24	PEER REVIEW REVISIONS

PREPARED FOR:
ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: AS NOTED
FEET

FILE: 2340702\C\D\2340702-DET
DWG.:
JOB. NO: 23407.02
SHEET C-203

STORMWATER REPORT

THORNDIKE PLACE
DOROTHY ROAD
ARLINGTON, MA

NOVEMBER 2020
REVISED: AUGUST 2021
SEPTEMBER 2023
JANUARY 2024
DECEMBER 2024

Owner/Applicant:

ARLINGTON LAND REALTY LLC
c/o Mugar Enterprises, Inc.
116 Huntington Avenue
Boston, MA 02116

BSC Job Number: 23407.00

Prepared by:

BSC GROUP

803 Summer Street
Boston, MA 02127

TABLE OF CONTENTS

SECTION 1.0

PROJECT INFORMATION

1.01 PROJECT DESCRIPTION

Arlington Land Realty, LLC (The Applicant) is seeking to construct a new age restricted multi-family housing development in Arlington, Massachusetts, hereinafter referred to as "the Project." The total property area is approximately 17.66 acres and is located off Dorothy Road near the intersection with Littlejohn Street. The project is bounded on the north by Dorothy Road, on the east by residential properties and Thorndike Field, and bounded on the south and west by Concord Turnpike (Route 2).

The Project consists of clearing and grubbing of the northwest section of the property and construction of one 4-story senior living residential building with a lower-level parking garage, six duplex townhouses with covered carports, as well as surface parking, walkways, utility services, and a stormwater management system. The buildings have a combined footprint of approximately 46,100 square feet.

The Project is designed to comply with the Massachusetts General Laws (M.G.L.) Chapter 40B, which allows developers to override certain aspects of municipal zoning bylaws by providing a certain percentage of affordable housing, as well as the Department of Environmental Protection's Stormwater Management Standards. There are wetland resource areas in the south, west and east portions of the property. The Project is concentrated in the northwest area of the property and minimizes impacts to the 100-foot wetland buffer zones. Part of the site is located within the 1% Chance Annual Flood as defined by FEMA which is regulated under the Wetlands Protection Act as Bordering Land Subject to Flooding (BLSF). Compensatory flood storage is proved at a 2:1 ratio as described in section 2.12 below. This Stormwater Report and design were extensively peer reviewed in November 2020 and August 2021 by BETA Group during the Comprehensive Permit Application process and again by both Hatch Associates Consultants, Inc. and GZA GeoEnvironmental, Inc. during the Conservation Commission's review of the Project's Notice of Intent.

1.02 PRE-DEVELOPMENT CONDITIONS

The existing site topography generally slopes southeast across the property towards the wetlands located on the property with slopes ranging from 0-15%. The current site is comprised of forest and the primary soil classification identified by the NRCS Web Soil Survey is udorthents (655), which accounts for the majority of the property and all of the project area. On November 25, 2020, BSC Group conducted three test pits on the site, the locations of which are noted on the Grading and Drainage plan, and the test pit logs attached in Appendix D. The test pits consisted primarily of fill material to a depth of 9-11 feet generally conforming with the soils mapping. Even though the material was fill, all samples textured as sandy loam in test pits TP-1 and TP-2, closest to the proposed stormwater management systems. At the bottom of test pit TP-3, a layer of clay material was found. Based on the fill materials found, runoff calculations have been performed using curve numbers corresponding to Hydrologic Soil Group (HSG) C.

Due to changes to the site design over the course of the Comprehensive Permit process, the proposed infiltration systems were relocated. As such, and to comply with Conditions C.2(k) and I.17 of the Comprehensive Permit that was issued by the Arlington Zoning Board of Appeals for the project in 2021, BSC conducted 8 additional soil test pits on May 18 and 19, 2023. The soil types for these test pits generally consisted of fill materials overlaying fine sandy loam, consistent with the previous test pits conducted in 2020. In accordance with the Comprehensive Permit conditions, BSC coordinated with the Town of Arlington to ensure that Town staff or a representative designated by the Town would be on site during test pit work to witness and confirm the results. BSC contacted Claire Ricker, Director of Planning & Community Development to coordinate a test pit witness for the Town and was referred through Town Engineer, Wayne Chouinard to David Morgan, Environmental Planner and Conservation Agent. Mr. Morgan arranged to have a representative from Whitestone Associates on site to witness the test pits on May 18 and 19, 2023. These test pit locations have been added to the revised Grading and Drainage plan and the additional test pit logs are included in Appendix D.

Five more test pits were conducted on April 17, 2024, to gather additional soil and groundwater data and confirm that the design of the infiltration system would meet the Stormwater Standards per the DEP's Massachusetts Stormwater Handbook. These test pits were consistent with the others that were conducted previously and consisted mainly of fill

that textured as sandy loam. One test pit, TP-9, found parent material 100-inches down, which was also a fine sandy loam. Additional test pit logs are included in Appendix D.

In November 2024, McPhail Associates, LLC (McPhail) performed two (2) soil borings on the Project site in the areas of proposed Infiltration Systems 1 and 7. These soil borings were performed to better understand the depth to a restrictive layer to more accurately determine the initial saturated thickness to be used in groundwater mounding analyses for the Project. A memorandum documenting this work is included in Appendix G. The borings showed a marine clay layer with a highest elevation between -12.1 and -17.4. Based on this additional data, all groundwater mounding analyses have been performed using an initial saturated thickness of 16-feet representing the depth between ESHGW (4.0) and the marine clay layer (-12.1).

The existing site being largely undeveloped has no existing drainage facilities and the majority of the stormwater runoff is directed to the wetlands on the property. A small portion of the site discharges to the north to Dorothy Road.

1.03 Post-Development Conditions

The proposed stormwater management system has been designed in a manner that will meet or exceed the provisions of the Department of Environmental Protection (DEP) Stormwater Management Standards for a new construction project.

Stormwater runoff from the site driveway and small parking/drop-off area at the main entrance to the building will be collected via a deep sump catch basin, conveyed through a water quality unit before being directed to an underground infiltration system. Stormwater runoff from a portion the driveway into the garage below the building will be collected via a trench drain and conveyed through a water quality unit before being directed to the underground system. Due to its elevation difference, this leg of the system has been provided with a backflow preventer device. This underground infiltration system provides for recharge to groundwater and provides peak flow rate attenuation. In larger storm events, this system will overflow through an outlet control structure to a flared end section with a rip-rap apron to the south.

Runoff from the townhouse and carport roofs, as well as the landscaped areas between the townhouses and 4-story building will be collected and routed to a second underground infiltration area. This underground infiltration area will also collect runoff from the roof of the 4-story building. This underground infiltration system provides for recharge to groundwater and provides peak flow rate attenuation. In larger storm events, this system will overflow through an outlet control structure to a flared end section with a rip-rap apron to the south.

Stormwater runoff from the townhouse driveways along Dorothy Rd will be collected via individual trench drains and routed to small underground infiltration chamber systems beneath each driveway. These systems provide localized infiltration to groundwater and help meet the required recharge volume for the Project. Overflow from these systems will be routed to the same infiltration system as the townhouse roofs and 4-story building.

Runoff from a small portion of the driveway to the garage will be collected in a trench drain and routed through a water quality unit for treatment prior to discharge through the flared end section with a rip-rap apron to the south.

Although all soils sampled in test pits TP-1 and TP-2, as well as the 8 test pits conducted in May 2023 and 5 conducted in April 2024, were identified as sandy loam (see above), the infiltration rate for silt loam (0.27-inches per hour) has been used in the infiltration system design to account for the materials found being primarily fill. Based upon the test pit data and groundwater monitoring performed in Spring 2024, the estimated seasonal high groundwater has been determined to be elevation 4.0. As such, to provide the minimum 2-feet of separation, the infiltration systems for the townhouse trench drains have been set with a bottom elevation of 7.0, the infiltration system collecting the majority of the driveways and parking areas has been set with a bottom elevation of 7.15, and the infiltration system collecting roofs and overflow from the townhouse trench drains has been set with a bottom elevation of 8.0. Groundwater mounding calculations for the 100-year event have been provided for all infiltration systems with less than 4.0-feet of separation to estimated seasonal high groundwater.

To provide emergency access to the sides and rear of the building, a reinforced grass access lane will be installed. A portion of this access lane will include a 6-foot wide, porous asphalt walkway to allow residents to have ADA/AAB accessible access the rear of the site. Both the reinforced grass and porous asphalt will allow stormwater runoff to freely infiltrate back to the ground and will result in negligible runoff.

Specifics of the project's compliance with the Stormwater Standards are discussed in detail in the following sections.

SECTION 2.0

DRAINAGE SUMMARY

2.01 Stormwater Standard 1 – New Stormwater Conveyances

Per Massachusetts Stormwater Management Standard #1, no new outfalls may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. No new untreated stormwater discharges are proposed. Rip-rap outlet protection sizing calculations are included in Section 6.0 of this Report.

2.02 Stormwater Standard 2 – Stormwater Runoff Rates

Watershed modeling was performed using HydroCAD Stormwater Modeling Software version 10.20, a computer aided design program that combines SCS runoff methodology with standard hydraulic calculations. A model of the site's hydrology was developed for both pre- and post-development conditions to assess the effects of the proposed development on the project site and surrounding areas.

Stormwater runoff was modeled using data from the NOAA 14++ rainfall atlas. The NOAA 14++ precipitation values are higher than the TP-40 rainfall values that are required by Wetlands Protection Act (WPA) and consistent with the requirements of the updated Arlington Wetland Bylaw. The following rainfall values have been used in the analysis and the NOAA 14++ data is included in Appendix D:

Storm Frequency	NOAA 14++ Rainfall (Inches)
2-year	4.02
10-year	6.40
25-year	8.30
50-year	9.67
100-year	11.50

The stormwater management system for the project has been designed such that the post-development conditions result in no increase to peak runoff rates off the property for the 2, 10, 25, 50, and 100-year, 24-hour storm events, as detailed in the table below.

Peak Flow Discharge Rates

Node 1L – Flow to Wetlands

Storm Event	Pre-Development Peak Discharge Rate (cfs)	Post-Development Peak Discharge Rate (cfs)	Change in Peak Discharge Rate (cfs)
2-Year	3.7	3.6	-0.1
10-Year	9.0	9.0	0.0
25-Year	13.7	13.7	0.0
50-Year	17.2	17.0	-0.2
100-Year	22.0	21.4	-0.6

Node 2L – Flow Towards Street

Storm Event	Pre-Development Peak Discharge Rate (cfs)	Post-Development Peak Discharge Rate (cfs)	Change in Peak Discharge Rate (cfs)
2-Year	0.3	0.3	0.0
10-Year	0.7	0.6	-0.1
25-Year	1.0	0.9	-0.1
50-Year	1.2	1.1	-0.1
100-Year	1.5	1.3	-0.2

Node 100L – Total Flows

Storm Event	Pre-Development Peak Discharge Rate (cfs)	Post-Development Peak Discharge Rate (cfs)	Change in Peak Discharge Rate (cfs)
2-Year	3.8	3.8	0.0
10-Year	9.4	9.4	0.0
25-Year	14.2	14.2	0.0
50-Year	17.9	17.8	-0.1
100-Year	22.7	22.3	-0.4

2.03 Stormwater Standard 3 – Groundwater Recharge

Groundwater recharge is provided on site via multiple underground structural infiltration systems beneath the surface parking area to the north of the building and smaller systems beneath each individual driveway of the duplex townhouses. Overall, the project will result in no loss of annual recharge to groundwater as required by Standard 3. Refer to Section 6.0 of this Report for groundwater recharge information.

As the townhouse driveway infiltration systems and the infiltration system collecting the majority of the driveway have more than 2-feet but less than 4-feet separation to estimated seasonal high groundwater, a mounding analysis has been performed in accordance with the Hantush Method for each to ensure that a groundwater mound does not extend into the bottom of the infiltration system preventing infiltration of the required recharge volume. This analysis has been performed utilizing the infiltration volume that occurs during the 100-year storm event and is included in Section 6.0 of this Report. As the system that collects the 4-story building roof has 4-feet of separation to groundwater, a mounding analysis is not required for this system.

2.04 Stormwater Standard 4 – TSS Removal

As a new development, the Project stormwater management system will achieve a TSS removal greater than 80%. The proposed stormwater management system has been designed to provide treatment of runoff in order to reduce suspended solids prior to discharge off-site through the implementation of the following best management practices:

- Deep Sump Hooded Catch Basins
- Proprietary Hydrodynamic Separators

- Underground Stormwater Infiltration Systems
- Rain Garden

The water quality volume is defined as the runoff volume requiring TSS Removal for the site and is equal to 0.5-inches of runoff over the total impervious area of the post-development site. The required water quality volume for the project is provided in Section 6.0 of this Report.

The underground infiltration systems have been sized to treat the required water quality volume and calculations are included in Section 6.0 of this Report.

A long-term pollution prevention plan complying with the requirements of Standard 4 is included in Section 4.0 of this Report.

2.05 Stormwater Standard 5 – Land Uses with Higher Potential Pollutant Loads

This standard is not applicable as the proposed project is not a land use with higher potential pollutant loads (LUHPPL).

2.06 Stormwater Standard 6 – Stormwater Discharges to a Critical Area

This standard is not applicable as runoff from the project site does not discharge to a critical area.

2.07 Stormwater Standard 7 – Redevelopment Projects

This project is a new development and therefore has been designed to fully comply with the Stormwater Management Standards.

2.08 Stormwater Standard 8 – Sedimentation and Erosion Control Plan

Erosion and sedimentation controls are shown on the Project Plans. Additionally, a Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan is included in Section 3.0 of this Report.

2.09 Stormwater Standard 9 – Long Term Operation and Maintenance Plan

A Long-Term Operation and Maintenance Plan is included in Section 4.0 of this Report.

2.10 Stormwater Standard 10 – Illicit Discharges

There are no known illicit discharges on the project site, and none are proposed. An illicit discharge compliance statement is included in Section 6.0 and will be signed by the Applicant prior to issuance of any permits.

2.11 Conclusion

The project has been designed in accordance with DEP Stormwater Management Standards. Through the construction of the aforementioned stormwater systems, the project will provide peak rate attenuation, TSS removal and groundwater recharge.

2.12 Compensatory Flood Storage

A portion of the project site is located within the 1% Chance Annual Flood as defined by FEMA, which is regulated under the Wetlands Protection Act as Bordering Land Subject to Flooding (BLSF). In order to protect the values provided by BLSF and prevent downstream flooding impacts, the project is required to provide compensatory flood storage on a 1-foot incremental basis to match whatever is lost due to the project's development. In order to provide this compensatory flood storage, the project will minimize the area of BLSF impacted and regrade a portion of the project property southeast of the proposed building as shown on the Plans. This regraded area will provide compensatory flood storage at a 2 to 1 ratio for any flood storage lost. A breakdown of the flood storage impacts and compensatory storage provided is shown below:

Elevations	Existing Incremental Available Flood Storage (CU.FT.)	Incremental Available Flood Storage with No Compensatory Storage (CU.FT.)	Incremental Flood Storage Change w/No Compensatory Storage (CU.FT.)	Proposed Incremental Compensatory Storage (CU.FT.)	Ratio of Compensatory Storage to Storage Lost
5.0 - 6.0	**136.0**	**67.5**	**-68.5**	**146.0**	**2.1**
6.0 - 6.8	**9,327.6**	**5,003.2**	**-4,324.4**	**9,014.8**	**2.1**

As shown above, the project will exceed the 2 to 1 ratio of compensatory flood storage for all flood storage lost due to the project development. In addition, as shown on the Plans, the proposed compensatory storage is hydrologically connected to the flood plain impacted by the project. Therefore, the project as proposed meets the applicable requirements for BLSF in the Wetlands Protection Act.

SECTION 3.0

CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN

3.0 CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL PLAN

This Section specifies requirements and suggestions for implementation of a Stormwater Pollution Prevention Plan (SWPPP) for **Thorndike Place, in Arlington, Massachusetts**. The SWPPP shall be provided and maintained on-site by the Contractor(s) during all construction activities. The SWPPP shall be updated as required to reflect changes to construction activity.

The stormwater pollution prevention measures contained in the SWPPP shall be at least the minimum required by Local Regulations. The Contractor shall provide additional measures to prevent pollution from stormwater discharges in compliance with the National Pollution Discharge Elimination System (NPDES) Phase II permit requirements and all other local, state and federal requirements.

The SWPPP shall include provisions for, but not be limited to, the following:

1. Construction Trailers
2. Lay-down Areas
3. Equipment Storage Areas
4. Stockpile Areas
5. Disturbed Areas

The Contractor shall NOT begin construction without submitting evidence that a NPDES Notice of Intent (NOI) governing the discharge of stormwater from the construction site for the entire construction period has been filed **at least fourteen (14) days prior to construction**. It is the Contractor's responsibility to complete and file the NOI, unless otherwise determined by the project team.

The cost of any fines, construction delays and remedial actions resulting from the Contractor's failure to comply with all provisions of local regulations and Federal NPDES permit requirements shall be paid for by the Contractor at no additional cost to the Owner.

As a requirement of the EPA's NPDES permitting program, each Contractor and Subcontractor responsible for implementing and maintaining stormwater Best Management Practices shall execute a Contractor's Certification form.

Erosion and Sedimentation Control

The Contractor shall be solely responsible for erosion and sedimentation control at the site. The Contractor shall utilize a system of operations and all necessary erosion and sedimentation control measures, even if not specified herein or elsewhere, to minimize erosion damage at the site to prevent the migration of sediment into environmentally sensitive areas. Environmentally sensitive areas include all wetland resource areas within, and downstream of, the site, and those areas of the site that are not being altered.

Erosion and sedimentation control shall be in accordance with this Section, the design drawings, and the following:

- "National Pollutant Discharge Elimination System General Permit for Discharges from Construction Activities (EPA Construction General Permit February 16, 2022).
- Massachusetts Stormwater Management Policy Handbook issued by the Massachusetts Department of Environmental Protection, January 2008.
- Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas, A Guide for Planners, Designers and Municipal Officials, March 1997.

The BMP's presented herein should be used as a guide for erosion and sedimentation control and are <u>not</u> intended to be considered specifications for construction. The most important BMP is maintaining a rapid

construction process, resulting in prompt stabilization of surfaces, thereby reducing erosion potential. Given the primacy of rapid construction, these guidelines have been designed to allow construction to progress with essentially no hindrance by the erosion control methods prescribed. These guidelines have also been designed with sufficient flexibility to allow the Contractor to modify the suggested methods as required to suit seasonal, atmospheric, and site-specific physical constraints.

Another important BMP is the prevention of concentrated water flow. Sheet flow does not have the erosive potential of a concentrated rivulet. These guidelines recommend construction methods that allow localized erosion control and a system of construction, which inhibits the development of shallow concentrated flow. These BMP's shall be maintained throughout the construction process.

CONTACT INFORMATION AND RESPONSIBLE PARTIES

The following is a list of all project-associated parties:

Owner
Arlington Land Realty, LLC
c/o Mugar Enterprises, Inc.
116 Huntington Avenue
Boston, MA 02116

Contractor
To be determined

Environmental Consultant
BSC Group, Inc.
803 Summer Street
Boston, MA 02127

Contact: Dominic Rinaldi, P.E.
Phone: (617) 896–4300
Email: drinaldi@bscgroup.com

Qualified SWPPP Inspectors
To Be Determined

3.1 Procedural Conditions of the Construction General Permit (CGP)

The following list outlines the Stormwater Responsibilities for all construction operators working on the Project. The operators below agree through a cooperative agreement to abide by the following conditions throughout the duration of the construction project, effective the date of signature of the required SWPPP. These conditions apply to all operators on the project site.

The project is subject to EPA's NPDES General Permit through the CGP. The goal of this permit is to prevent the discharge of pollutants associated with construction activity from entering the existing and proposed storm drain system or surface waters.

All contractors/operators involved in clearing, grading and excavation construction activities must sign the appropriate certification statement required, which will remain with the SWPPP. The owner must also sign

a certification, which is to remain with the SWPPP in accordance with the signatory requirements of the SWPPP.

Once the SWPPP is finalized, a signed copy, plus supporting documents, must be held at the project site during construction. A copy must remain available to EPA, State and Local agencies, and other interested parties during normal business hours.

The following items associated with this SWPPP must be posted in a prominent place at the construction site until final stabilization has been achieved:

- The completed/submitted NOI form
- Location where the public can view the SWPPP during normal business hours
- A copy of the signed/submitted NOI, permit number issued by the EPA and a copy of the current CGP.

Project specific SWPPP documents are not submitted to the US EPA unless the agency specifically requests a copy for review. SWPPP documents requested by a permitting authority, the permitee(s) will submit it in a timely manner.

EPA inspectors will be allowed free and unrestricted access to the project site and all related documentation and records kept under the conditions of the permit.

The permitee is expected to keep all BMP's and Stormwater controls operating correctly and maintained regularly.

Any additions to the project which will significantly change the anticipated discharges of pollutants, must be reported to the EPA. The EPA should also be notified in advance of any anticipated events of noncompliance. The permitee must also orally inform the EPA of any discharge, which may endanger health or the environment within 24 hours, with a written report following within 5 days.

In maintaining the SWPPP, all records and supporting documents will be compiled together in an orderly fashion. Inspection reports and amendments to the SWPPP must remain with the document. Federal regulations require permitee(s) to keep their Project Specific SWPPP and all reports and documents for at least three (3) years after the project is complete.

3.2 Existing Site and Soil Conditions

The total project area is approximately 17.66 acres and is located off Dorothy Road. The project is bounded on the north by Dorothy Road, bounded on the east by residential properties, and bounded on the south and west by Concord Turnpike (Route 2).

The current site is comprised of forest and the primary soil classification identified by the NRCS Web Soil Survey is udorthents (655), which accounts for the majority of the property and all of the project area. On November 25, 2020, BSC Group conducted three test pits on the site, the locations of which are noted on the Grading and Drainage plan, and the test pit logs are attached in Appendix D. The test pits consisted of primarily fill material to a depth of 9-11 feet generally conforming with the soils mapping. Even though the material was fill, all samples textured as sandy loam in test pits TP-1 and TP-2, closest to the proposed stormwater management systems. At the bottom of test pit TP-3, a layer of clay material was found. On May 18 and 19, 2023, BSC Group conducted 8 additional test pits on site, and on April 17, 2024, BSC Group conducted another 5 test pits on site to determine soil conditions at the locations of each of the infiltration systems in the revised drainage design. These test pits were consistent with the 2020 test pits and generally consisted of fill material over fine sandy loam. These test pits have been added to the Grading and Drainage plan and test pit logs are attached in Appendix D as well. Based on the fill materials found,

runoff calculations have been performed using curve numbers corresponding to Hydrologic Soil Group (HSG) C.

3.3 Project Description and Intended Construction Sequence

The site is currently comprised of woods. The proposed activities will include the following major components:

- The construction of one (1) multi-family housing building and six (6) duplex townhouses with associated parking, driveways, walkways, and retaining walls,
- The construction of stormwater management systems,
- Site grading and compensatory flood storage creation, and
- Utility connections and installation.

The proposed project will disturb a total of approximately 175,000± S.F. (4.02± acres).

Soil disturbing activities will include site demolition, installing stabilized construction exits, installation of erosion and sedimentation controls, grading, storm drain inlets, stormwater management systems, utilities, building foundation, construction of site driveways and preparation for final landscaping. Please refer to Table 1 for the projects anticipated construction timetable. A description of BMP's associated with project timetable and construction-phasing elements is provided in this Erosion and Sediment Control Plan.

Table 1 – Anticipated Construction Timetable

Construction Phasing Activity	Anticipated Timetable
Grubbing and Stripping of Limits of Construction Phase	To be determined
Rough Site Grading and Site Utilities	To be determined
Utility Plan Construction	To be determined
Landscaping	To be determined

3.4 Potential Sources of Pollution

Any project site activities that have the potential to add pollutants to runoff are subject to the requirements of the SWPPP. Listed below are a description of potential sources of pollution from both sedimentation to Stormwater runoff, and pollutants from sources other than sedimentation.

Table 2 – Potential Sources of Sediment to Stormwater Runoff

Potential Source	Activities/Comments
Construction Site Entrance and Site Vehicles	Vehicles leaving the site can track soils onto public roadways. Site Vehicles can readily transport exposed soils throughout the site and off-site areas.
Grading Operations	Exposed soils have the potential for erosion and discharge of sediment to off-site areas.
Material Excavation, Relocation, and Stockpiling	Stockpiling of materials during excavation and relocation of soils can contribute to erosion and sedimentation. In addition, fugitive dust from stockpiled material, vehicle transport and site grading can be deposited in wetlands and waterway.
Landscaping Operations	Landscaping operations specifically associated with exposed soils can contribute to erosion and sedimentation. Hydroseeding, if not properly applied, can runoff to adjacent wetlands and waterways.

Table 3 – Potential Pollutants and Sources, other than Sediment to Stormwater Runoff

Potential Source	Activities/Comments
Staging Areas and Construction Vehicles	Vehicle refueling, minor equipment maintenance, sanitary facilities and hazardous waste storage
Materials Storage Area	General building materials, solvents, adhesives, paving materials, paints, aggregates, trash, etc.
Construction Activities	Construction, paving, curb/gutter installation, concrete pouring/mortar/stucco

3.5 Erosion and Sedimentation Control Best Management Practices

All construction activities will implement Best Management Practices (BMP's) in order to minimize overall site disturbance and impacts to the sites natural features. Please refer to the following sections for a detailed description of site specific BMP's. In addition, an Erosion and Sedimentation Control Plan is provided in the Site Plans.

3.6 Timetable and Construction Phasing

This section provides the Owner and Contractor with a suggested order of construction that shall minimize erosion and the transport of sediments. The individual objectives of the construction techniques described herein shall be considered an integral component of the project design intent of each project phase. The construction sequence is not intended to prescribe definitive construction methods and should not be interpreted as a construction specification document. However, the Contractor shall follow the general construction phase principles provided below:

- Protect and maintain existing vegetation wherever possible.
- Minimize the area of disturbance.
- To the extent possible, route unpolluted flows around disturbed areas.
- Install mitigation devices as early as possible.
- Minimize the time disturbed areas are left unstabilized.
- Maintain siltation control devices in proper condition.
- The contractor should use the suggested sequence and techniques as a general guide and modify the suggested methods and procedures as required to best suit seasonal, atmospheric, and site specific physical constraints for the purpose of minimizing the environmental impact of construction.

Demolition, Grubbing and Stripping of Limits of Construction Phase

- Install Temporary Erosion Control (TEC) devices as required to prevent sediment transport into resource areas.
- Place a ring of silt socks and/or haybales around stockpiles.
- Stabilize all exposed surfaces that will not be under immediate construction.
- Store and/or dispose all pavement and building demolition debris as indicated in accordance with all applicable local, state, and federal regulations.

Driveway Area Sub-Base Construction

- Install temporary culverts and diversion ditches and additional TEC devices as required by individual construction area constraints to direct potential runoff toward detention areas designated for the current construction phase.
- Compact gravel as work progresses to control erosion potential.

- Apply water to control air suspension of dust.
- Avoid creating an erosive condition due to over-watering.
- Install piped utility systems as required as work progresses, keeping all inlets sealed until all downstream drainage system components are functional.

Binder Construction

- Fine grade gravel base and install processed gravel to the design grades.
- Compact pavement base as work progresses.
- Install pavement binder coat starting from the downhill end of the site and work toward the top.

Finish Paving

- Repair and stabilize damaged side slopes.
- Clean inverts of drainage structures.
- Install final top coat of pavement.

Final Clean-up

- Clean inverts of culverts and catch basins.
- Remove sediment and debris from rip-rap outlet areas.
- Remove TEC devices only after permanent vegetation and erosion control has been fully established.

3.7 Site Stabilization

Grubbing Stripping and Grading

- Erosion control devices shall be in place as shown on the design plans before grading commences.
- Stripping shall be done in a manner, which will not concentrate runoff. If precipitation is expected, earthen berms shall be constructed around the area being stripped, with a silt sock, silt fence or haybale dike situated in an arc at the low point of the berm.
- If intense precipitation is anticipated, silt socks, haybales, dikes and /or silt fences shall be used as required to prevent erosion and sediment transport. The materials required shall be stored on site at all time.
- If water is required for soil compaction, it shall be added in a uniform manner that does not allow excess water to flow off the area being compacted.
- Dust shall be held at a minimum by sprinkling exposed soil with an appropriate amount of water.

Maintenance of Disturbed Surfaces

- Runoff shall be diverted from disturbed side slopes in both cut and fill.
- Mulching may be used for temporary stabilization.
- Silt sock, haybale or silt fences shall be set where required to trap products of erosion and shall be maintained on a continuing basis during the construction process.

Loaming and Seeding

- Loam shall not be placed unless it is to be seeded directly thereafter.
- All disturbed areas shall have a minimum of 4” of loam placed before seeded and mulched.
- Consideration shall be given to hydro-mulching, especially on slopes in excess of 3 to 1.
- Loamed and seeded slopes shall be protected from washout by mulching or other acceptable slope protection until vegetation begins to grow.

Stormwater Collection System Installation

- The Stormwater drainage system shall be installed from the downstream end up and in a manner which will not allow runoff from disturbed areas to enter pipes.
- Excavation for the drainage system shall not be left open when rainfall is expected overnight. If left open under other circumstances, pipe ends shall be closed by a staked board or by an equivalent method.
- All catch basin openings shall be covered by a silt bag between the grate and the frame or protected from sediment by silt fence surrounding the catch basin grate.
- During the installation of the infiltration systems, ensure that loose material from the construction of the town home roof shingles is swept and removed from the area prior to connecting the roof drains to the infiltration systems. No roof drains shall be connected to the infiltration systems until all tributary roof areas have been thoroughly cleared of debris that could impact the infiltration system functions.

Completion of Paved Areas

- During the placement of sub-base and pavement, the entrance to the Stormwater drainage systems shall be sealed when rain is expected. When these entrances are closed, consideration must be given to the direction of run-off and measures shall be undertaken to minimize erosion and to provide for the collection of sediment.
- In some situations, it may be necessary to keep catch basins open.
- Appropriate arrangements shall be made downstream to remove all sediment deposition.

Stabilization of Surfaces

- Stabilization of surfaces includes the placement of pavement, rip-rap, wood bark mulch and the establishment of vegetated surfaces.
- Upon completion of construction, all surfaces shall be stabilized even though it is apparent that future construction efforts will cause their disturbance.
- Vegetated cover shall be established during the proper growing season and shall be enhanced by soil adjustment for proper pH, nutrients and moisture content.
- Surfaces that are disturbed by erosion processes or vandalism shall be stabilized as soon as possible.
- Areas where construction activities have permanently or temporarily ceased shall be stabilized within 14 days from the last construction activity, except when construction activity will resume within 21 days (e.g., the total time period that construction activity is temporarily ceased is less than 21 days).
- Hydro-mulching of grass surfaces is recommended, especially if seeding of the surfaces is required outside the normal growing season.
- Hay mulch is an effective method of temporarily stabilizing surfaces, but only if it is properly secured by branches, weighted snow fences or weighted chicken wire.

3.8 Temporary Structural Erosion Control Measures

Temporary erosion control measures serve to minimize construction-associated impacts to wetland resource and undisturbed areas. Please refer to the following sections for a description of temporary erosion control measures implemented as part of the project and this sample SWPPP.

3.8.1 Silt Socks, Haybales, and Silt Fencing

The siltation barriers will demarcate the limit of work, form a work envelope and provide additional assurance that construction equipment will not enter the adjacent wetlands or undisturbed portions of the site. All barriers will remain in place until disturbed areas are stabilized.

3.8.2 Temporary Stormwater Diversion Swale

A temporary diversion swale is an effective practice for temporarily diverting stormwater flows and to reduce stormwater runoff velocities during storm events. The swale channel can be installed before infrastructure construction begins at the site, or as needed throughout the construction process. The diversion swale should be routinely compacted or seeded to minimize the amount of exposed soil.

3.8.3 Dewatering Basins

Dewatering may be required during stormwater system, foundation construction and utility installation. Should the need for dewatering arise, groundwater will be pumped directly into a temporary settling basin, which will act as a sediment trap during construction. All temporary settling basins will be located within close proximity of daily work activities. Prior to discharge, all groundwater will be treated by means of the settling basin or acceptable substitute. Discharges from sediment basins will be free of visible floating, suspended and settleable solids that would impair the functions of a wetland or degrade the chemical composition of the wetland resource area receiving ground or surface water flows and will be to the combined system.

3.8.4 Material Stockpiling Locations

Piping and trench excavate associated with the subsurface utility work will be contained with a single row of silt socks and/or haybales.

3.9 Permanent Structural Erosion Control Measures

Permanent erosion control measures serve to minimize post-construction impacts to wetland resource areas and undisturbed areas. Please refer to the Site Plans and Long-Term Operations and Maintenance Plan for a description of permanent erosion control measures implemented as part of the project and this SWPPP.

3.10 Good Housekeeping Best Management Practices

3.10.1 Street Sweeping

Dorothy Road in front of the project property shall be swept clean on a daily basis at the conclusion of the work day of any soils tracked onto it from the project site. All sweepings shall be disposed of off-site in accordance with all applicable laws and regulations.

3.10.2 Material Handling and Waste Management

Solid waste generation during the construction period will be primarily construction debris. The debris will include scrap lumber (used forming and shoring pallets and other shipping containers), waste packaging materials (plastic sheeting and cardboard), scrap cable and wire, roll-off containers (or dumpsters) and will be removed by a contract hauler to a properly licensed landfill. The roll-off containers will be covered with a properly secured tarp before the hauler exits the site. In addition to construction debris, the construction work force will generate some amount of household-type wastes (food packing, soft drink containers, and other paper). Trash containers for these wastes will be located around the site and will be emptied regularly so as to prevent wind-blown litter. This waste will also be removed by a contract hauler.

All hazardous waste material such as oil filters, petroleum products, paint and equipment maintenance fluids will be stored in structurally sound and sealed shipping containers in the hazardous-materials storage area and segregated from other non-waste materials. Secondary containment will be provided for all

materials in the hazardous materials storage area and will consist of commercially available spill pallets. Additionally, all hazardous materials will be disposed of in accordance with federal, state and municipal regulations.

Two temporary sanitary facilities (portable toilets) will be provided at the site in the combined staging area. The toilets will be away from a concentrated flow path and traffic flow and will have collection pans underneath as secondary treatment. All sanitary waste will be collected from an approved party at a minimum of three times per week.

3.10.3 Building Material Staging Areas

Construction equipment and maintenance materials will be stored at the combined staging area and materials storage areas. Silt fence will be installed around the perimeter to designate the staging and materials storage area. A watertight shipping container will be used to store hand tools, small parts and other construction materials.

Non-hazardous building materials such as packaging material (wood, plastic and glass) and construction scrap material (brick, wood, steel, metal scraps, and pine cuttings) will be stored in a separate covered storage facility adjacent to other stored materials. All hazardous-waste materials such as oil filters, petroleum products, paint and equipment maintenance fluids will be stored in structurally sound and sealed containers under cover within the hazardous materials storage area.

Large items such as framing materials and stockpiled lumber will be stored in the open storage area. Such materials will be elevated on wood blocks to minimize contact with runoff.

The combined storage areas are expected to remain clean, well-organized and equipped with ample cleaning supplies as appropriate for the materials being stored. Perimeter controls such as containment structures, covers and liners will be repaired or replaced as necessary to maintain proper function.

3.10.4 Designated Washout Areas

Designated temporary, below-ground concrete washout areas will be constructed, as required, to minimize the pollution potential associated with concrete, paint, stucco, mixers etc. Signs will, if required, be posted marking the location of the washout area to ensure that concrete equipment operators use the proper facility. Concrete pours will not be conducted during or before an anticipated precipitation event. All excess concrete and concrete washout slurries from the concrete mixer trucks and chutes will be discharged to the washout area or hauled off-site for disposal.

3.10.5 Equipment/Vehicle Maintenance and Fueling Areas

Several types of vehicles and equipment will be used on-site throughout the project including graders, scrapers, excavators, loaders, paving equipment, rollers, trucks and trailers, backhoes and forklifts. All major equipment/vehicle fueling and maintenance will be performed off-site. A small, 20-gallon pickup bed fuel tank will be kept on-site in the combined staging area. When vehicle fueling must occur on-site, the fueling activity will occur in the staging area. Only minor equipment maintenance will occur on-site. Vehicular refueling or maintenance shall not be allowed within the Adjacent Upland Resource Area (AURA) or in any protected wetland resource areas as defined by the Town of Arlington Regulations for Wetland Protection. All equipment fluids generated from maintenance activities will be disposed of into designated drums stored on spill pallets. Absorbent, spill-cleanup materials and spill kits will be available at the combined staging and materials storage area. Drip pans will be placed under all equipment receiving maintenance and vehicles and equipment parked overnight.

3.10.6 Equipment/Vehicle Wash down Area

All equipment and vehicle washing will be performed off-site.

3.10.7 Spill Prevention Plan

A spill containment kit will be kept on-site in the Contractor's trailer and/or the designated staging area throughout the duration of construction. Should there be an accidental release of petroleum product into a resource area, the appropriate agencies will be immediately notified.

3.10.8 Inspections

Maintenance of existing and proposed BMP's to address stormwater management facilities during construction is an on-going process. The purpose of the inspections is to observe all sources of stormwater or non-stormwater discharge as identified in the SWPPP as well as the status of the receiving waters and fulfill the requirements of the Order of Conditions. The following sections describe the appropriate inspection measures to adequately implement the project's SWPPP. A blank inspection form is provided at the end of this section. Completed inspection forms are to be maintained on site.

Inspection Personnel

The owner's appointed representative will be responsible for performing regular inspections of erosion controls and ordering repairs as necessary.

Inspection Frequency

Inspections will be performed by qualified personnel once every 7 days, in accordance with the CGP. The inspections must be documented on the inspection form provided at the end of this section, and completed forms will be provided to the on-site supervisor and maintained at the Owner's office throughout the entire duration of construction.

Inspection Reporting

Each inspection report will summarize the scope of the inspection, name(s) and qualifications of personnel making the inspection, and major observations relating to the implementation of the SWPPP, including compliance and non-compliance items. Completed inspection reports will remain with the completed SWPPP on site.

3.10.9 Amendment Requirements

The final SWPPP is intended to be a working document that is utilized regularly on the construction site, and provides guidance to the Contractor. It must reflect changes made to the originally proposed plan and will be updated to include project specific activities and ensure that they are in compliance with the NPDES General Permit and state and local laws and regulations. It should be amended whenever there is a change in design, construction, operation or maintenance that affects discharge of pollutants. The following items should be addressed should an amendment to the SWPPP occur:

- Dates of certain construction activities such as major grading activities, clearing and initiation of and completion of stabilization measures should be recorded.
- Future amendments to the SWPPP will be recorded as required. As this SWPPP is amended, all amendments will be kept on site and made part of the SWPPP.
- Upon completion of site stabilization (completed as designed and/or 70% background vegetative cover), it can be documented and marked on the plans. Inspections are no longer required at this time.
- Inspections often identify areas not included in the original SWPPP, which will require the SWPPP to be amended. These updates should be made within seven days of being recognized by the inspector.

3.11 SWPPP Inspection and Maintenance Report

The following form is an example to be used for SWPPP Inspection Reporting.

Stormwater Construction Site Inspection and Maintenance Report

TO BE COMPLETED AT LEAST EVERY 7 DAYS. AFTER SITE STABILIZATION, TO BE COMPLETED AT LEAST ONCE PER MONTH FOR THREE YEARS OR UNTIL A NOTICE OF TERMINATION IS FILED (IF APPLICABLE).

General Information			
Project Name	Thorndike Place		
NPDES Tracking No. (if applicable)		**Location**	Dorothy Road Arlington, MA
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Inspector's Qualifications			
Describe present phase of construction			
Type of Inspection: ❑ Regular ❑ Pre-storm event ❑ During storm event ❑ Post-storm event			
Weather Information			
Has there been a storm event since the last inspection? ❑Yes ❑No **If yes, provide:** Storm Start Date & Time: Storm Duration (hrs): Approximate Amount of Precipitation (in):			
Weather at time of this inspection? ❑ Clear ❑Cloudy ❑ Rain ❑ Sleet ❑ Fog ❑ Snowing ❑ High Winds ❑ Other: Temperature:			
Have any discharges occurred since the last inspection? ❑Yes ❑No **If yes, describe:**			
Are there any discharges at the time of inspection? ❑Yes ❑No **If yes, describe:**			

Site-specific BMPs

- *Number the structural and non-structural BMPs identified in your SWPPP on your site map and list them below (add as many BMPs as necessary). Carry a copy of the numbered site map with you during your inspections. This list will ensure that you are inspecting all required BMPs at your site.*
- *Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.*

	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed and Notes Action required by whom and when
1	Catch Basin Protection	❑Yes ❑No	❑Yes ❑No	

	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed and Notes Action required by whom and when
2	Haybale & Silt Fencing	❑Yes ❑No	❑Yes ❑No	
3	Straw Wattles	❑Yes ❑No	❑Yes ❑No	
4	Construction Entrance	❑Yes ❑No	❑Yes ❑No	
5	Sediment Basins	❑Yes ❑No	❑Yes ❑No	
6	Dewatering Pit	❑Yes ❑No	❑Yes ❑No	
7		❑Yes ❑No	❑Yes ❑No	

Overall Site Issues
Below are some general site issues that should be assessed during inspections. Customize this list as needed for conditions at your site.

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes Action required by whom and when
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	❑Yes ❑No	❑Yes ❑No	
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	❑Yes ❑No	❑Yes ❑No	
3	Are perimeter controls and sediment barriers adequately installed	❑Yes ❑No	❑Yes ❑No	

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes Action required by whom and when
	(keyed into substrate) and maintained?			
4	Are discharge points and receiving waters free of any sediment deposits?	❑Yes ❑No	❑Yes ❑No	
5	Are storm drain inlets properly protected?	❑Yes ❑No	❑Yes ❑No	
6	Is the construction exit preventing sediment from being tracked into the street?	❑Yes ❑No	❑Yes ❑No	
7	Is trash/litter from work areas collected and placed in covered dumpsters?	❑Yes ❑No	❑Yes ❑No	
8	Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	❑Yes ❑No	❑Yes ❑No	
9	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	❑Yes ❑No	❑Yes ❑No	Vehicle Maintenance not allowed on site
10	Are materials that are potential stormwater contaminants stored inside or under cover?	❑Yes ❑No	❑Yes ❑No	
11	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	❑Yes ❑No	❑Yes ❑No	
12	(Other)	❑Yes ❑No	❑Yes ❑No	

Non-Compliance

Describe any incidents of non-compliance not described above:

CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name and title: ____
(Qualified Person Performing the Inspection)

Signature:________________________________ **Date:** ______________

Print name and title: ____
(Contractor/Operator)

Signature:________________________________ **Date:**______________

SECTION 4.0

LONG-TERM POLLUTION PREVENTION & OPERATION AND MAINTENANCE PLAN

4.0 LONG-TERM POLLUTION PREVENTION & OPERATION AND MAINTENANCE PLAN

As required by Standard #4 of the Stormwater Management Policy, this Long-Term Pollution Prevention Plan has been developed for source control and pollution prevention at the site after construction.

MAINTENANCE RESPONSIBILITY

Ensuring that the provisions of the Long-Term Pollution Prevention Plan are followed will be the responsibility of The Applicant, Arlington Land Realty, LLC.

GOOD HOUSEKEEPING PRACTICES

The site to be kept clean of trash and debris at all times. Trash, junk, etc. is not to be left outside.

VEHICLE WASHING CONTROLS

The following BMP's, or equivalent measures, methods or practices are required if you are engaged in vehicle washing and/or steam cleaning:

> It is allowable to rinse down the body or a vehicle, including the bed of a truck, with just water without doing any wash water control BMP's.
>
> If you wash (with mild detergents) on an area that infiltrates water, such as gravel, grass, or loose soil, it is acceptable to let the wash water infiltrate as long as you only wash the body of vehicles.
>
> However, if you wash on a paved area and use detergents or other cleansers, or if you wash/rinse the engine compartment or the underside of vehicles, you must take the vehicles to a commercial vehicle wash.

REQUIREMENTS FOR ROUTINE INSPECTIONS AND MAINTENANCE OF STORMWATER BMPS

All stormwater BMPs are to be inspected and maintained as follows;

Haybales, Silt Fence, and other temporary measures

The temporary erosion control measures will be installed up gradient of any wetland resource area where any disturbance or alteration might otherwise allow for erosion or sedimentation. They will be regularly inspected to ensure that they are functioning adequately. Additional supplies of these temporary measures will be stockpiled on site for any immediate needs or routine replacement.

Deep Sump Hooded Catch Basins

Regular maintenance is essential. Catch basins remain effective at removing pollutants only if they are cleaned out frequently. Inspect or clean basins at least four times per year and at the end of the foliage and snow removal seasons. Sediments must also be removed four times per year or whenever the depth of the deposits in the catch basin sump is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.

Water Quality Treatment Units

The water quality treatment structures require periodic inspection and cleaning to maintain operation and function. Owners should have these units inspected on a semi-annual basis and after periods of intense precipitation. Inspections can be done by using a clear Plexiglas tube ("sludge judge") to extract a water column sample. When sediment accumulation reaches 15% of storage capacity, cleaning of the unit is required.

These water quality structures must and will be checked and cleaned immediately after petroleum spills; contact appropriate regulatory agencies.

Maintenance of these units should be done by a vacuum truck that will remove the water, sediment, debris, floating hydrocarbons and other materials in unit. Proper cleaning and disposal of the removed materials and liquid must be followed.

Underground Infiltration Systems

Maintenance is required for the proper operation of the underground infiltration system. Infiltration systems are prone to failure due to clogging if the upstream water quality units are not maintained. The use of pretreatment BMPs will minimize failure and maintenance requirements.

After construction, the infiltration system shall be inspected after every major storm for the first few months to ensure proper stabilization and function. Water levels in the access ports shall be recorded over several days to check the drainage of the systems. It is recommended that a log book be maintained showing the depth of water in the detention/infiltration systems at each observation in order to determine the rate at which the system dewaters after runoff producing storm events. Once the performance characteristics of the detention/infiltration have been verified, the monitoring schedule can be reduced to an annual basis, unless the performance data suggests that a more frequent schedule is required.

Preventive maintenance on the infiltration system shall be performed at least twice a year, and sediment shall be removed from any and all pretreatment and collection structures. Sediment shall be removed when deposits approach within six inches of the invert heights of connecting pipes between unit rows, or in sumped inlet structures. Ponded water inside the systems (as visible from the access ports) that remains after several days most likely indicates that the bottom of the system is clogged and will require cleaning or replacement.

The system is designed with a defined top portal area at the “down-flow” end of the chamber that can be cut out to accept up to a 10-inch diameter riser pipe. The 10-inch riser can be used as an observation well and as access for a vacuum truck tube for use in removing sediment. The “down flow” ends of the units have end walls that are closed on the bottom. The closed bottom functions like a coffer dam, with most of the sediment depositing prior to flowing into the next chamber, facilitating its removal through the riser pipe, which is positioned directly above this area.

In addition to the routine maintenance described above, an operation and maintenance log. This log must be maintained for a minimum of three years after construction of the system, and include inspection reports and notes on any repairs, replacement, and disposal (including material and location). This log must be made available to MassDEP and the Conservation Commission upon request. In addition, members and agents of MassDEP shall be allowed to enter and inspect the property and drainage system to ensure compliance with this O&M plan.

Pipe Outlet Protection

The outlet protection should be checked at least annually and after every major storm. If the rip-rap has been displaced, undermined or damaged, it should be repaired immediately. The channel immediately below the outlet should be checked to see that erosion is not occurring. The downstream channel should be kept clear of obstructions such as fallen trees, debris, and sediment that could change flow patterns and/or tailwater depths on the pipes. Repairs must be carried out immediately to avoid additional damage to the outlet protection apron.

PROVISIONS FOR MAINTENANCE OF LAWNS, GARDENS AND OTHER LANDSCAPE AREAS

Suggested Maintenance Operations

A. Trees and Shrubs

Disease and Pest Management - Prevention of disease or infestation is the first step of Pest Management. A plant that is in overall good health is far less susceptible to disease. Good general landscape maintenance can reduce problems from disease.

Inspections of plant materials for signs of disease or infestation are to be performed monthly by the Landscape Maintenance Contractor’s Certified Arborist. This is a critical step for early diagnosis. Trees and Shrubs that have been diagnosed to have a plant disease or an infestation of insect pests are to be treated promptly with an appropriate material by a licensed applicator.

Fertilization - Trees and shrubs live outside their natural environment and should be given proper care to maintain health and vigor. Fertilizing trees and shrubs provides the plants with nutrients needed to resist insect attack, to resist drought and to grow thicker foliage. Fertilizing of new and old trees may be done in one of three ways, in either the early spring or the late fall.

- Systemic Injection of new and existing trees on trees 2 inches or greater in diameter. You must be licensed to apply this method.
- Soil Injection – a liquid fertilizer with a product such as Arbor Green or Rapid Grow injected into the soil under the drip zone of a tree or shrub. Material must be used according to manufacturers' specifications to be effective. Outside contracting is recommended.
- Punch Bar Method – a dry fertilizer such as 10-10-10, may be used by punched holes in the drip zone of the tree 12-18" deep, two feet apart around the circumference, to the edge of the drip line. Three pounds of fertilizer should be used per diameter inch for trees with trunks six inches or more in diameter.
- Fertilizer of shrubs – use a fertilizer such as 10-10-10, broadcast over the planting area according to the manufacturers' rate and water in.
- All fertilization must be noted on daily maintenance log.

Watering - Trees and Shrubs will need supplemental watering to remain in vigorous health. All new plants need to be watered once a week in cool weather, twice a week during warm weather, and up to three times in a week during periods of extreme heat and drought. Trees and shrubs should be watered in such a manner as to totally saturate the soil in the root zone area. Over-watering or constant saturation of the soil must be avoided as this could lead to root rot and other disease problems. The use of a soil moisture meter can help you monitor the soil's water intake.

Plant Replacement - Unhealthy plants that may cause widespread infestation of other nearby plants shall be immediately removed from the site. Any vegetation removed from the site must be recorded and submitted with the daily maintenance log. The area shall be treated to prevent further infestation. The plant shall then be replaced with a healthy specimen of the same species and size. This work shall have a pre-established budget allowance for the year.

A spring inspection of all plant materials shall be performed to identify those plant materials that are not in vigorously healthy condition. Unhealthy plant materials shall be evaluated. If the problem is determined to be minor the plant material shall be given appropriate restorative care in accordance with this maintenance guideline until it is restored to a vigorously healthy condition. Unhealthy plant materials that do not respond to restorative care or are determined to be beyond saving shall be replaced with a healthy specimen of the same species and size. In the case of the necessity of replacing extremely large plant materials the Landscape Architect shall determine the size of the replacement plant.

Pruning - Proper pruning is the selective removal of branches without changing the plant's natural appearance, or habit of growth. All tree pruning is to be performed by a licensed Arborist. All branches that are dead, broken, scared or crossing should be removed. All cuts should be made at the collar and not cut flush with the base.

Pruning on the site shall be done for the following purposes;

- To maintain or reduce the size of a tree or shrub
- To remove dead, diseased or damaged branches
- To rejuvenate old shrubs and encourage new growth
- To stimulate future flower and fruit development
- To maximize the visibility of twig color
- To prevent damage and reduce hazards to people and properties

All shrubs are recommended to be pruned on an annual basis to prevent the shrub from becoming overgrown and eliminate the need for drastic pruning. There are several types of pruning for deciduous shrubs. Hand snips should be used to maintain a more natural look or hand shears can be used for a more formal appearance.

Winter Protection - All trees and shrubs are to be watered, fertilized, and mulched before the first frost. All stakes should be checked and ties adjusted. Damaged branches should be pruned.

Broadleaf and Coniferous Evergreen plant materials are to be sprayed with an anti-desiccant product to prevent winter burn. The application shall be repeated during a suitable mid-winter thaw.

Shrubs located in areas likely to be piled with snow during snow removal (but not designated as Snow Storage Areas) shall be marked by six-foot high poles with bright green banner flags. Stockpiles of snow are not to be located in these areas due to potential damage to the plant materials from both the weight of the snow and the snow melting chemicals.

At the fall landscape maintenance conference parameters will be discussed between the Landscape Maintenance Contractor and the snow removal contractor to assure minimal damage and loss of landscape amenities during the winter season.

Seasonal Clean Up - A thorough spring cleanup is to be performed. This includes the removal and replacement of dead or unhealthy plant materials and the cleanup of plant debris and any general debris that has accumulated over the winter season. Mulch is to be lightly raked to clean debris from the surface without removing any mulch. Twigs and debris are to be removed from the planting beds throughout the growing season.

Mulching - Planting beds shall be mulched with a treated shredded hardwood mulch free from dirt, debris, and insects. A sample of this mulch shall be given to the Owner for approval prior to installation.

Maintain a 2-3" maximum depth and keep free of weeds either by hand weeding or by the use of a pre-emergent weed control such as Treflan or Serfian. Seasonal re-mulching shall occur as necessary in the spring and the fall to maintain this minimum depth. When new mulch is added to the planting bed it shall be spread to create a total depth of no more than three inches. Edges should be maintained in a cleanly edged fashion.

Mulch shall not be placed directly against the trunk of any tree or shrub.

B. Groundcover and Perennials

Disease and Pest Management – Pesticides and herbicides should be applied only as problems occur, with the proper chemical applied only by a trained professional or in the case of pesticide, a Certified Pesticide Applicator. Plants should be monitored weekly and treated accordingly.

Fertilizer – The health of the plants can be maintained or improved, and their growth encouraged by an application of complete fertilizer. Apply a fertilizer such as 4-12-4 as growth becomes apparent and before mulching. Apply to all groundcover and perennial planting areas by hand and avoid letting the fertilizer come in contact with the foliage, or use a liquid fertilizer and apply by soaking the soil. Apply according to the manufacturers' specifications.

Fertilization shall stop at the end of July.

Water – Groundcovers and Perennials will need supplemental watering in order to become established, healthy plants. All new plants need to be watered once a week in cool weather, twice a week during warm weather, and up to three times in a week during periods of extreme heat and drought. Until established, groundcovers and perennials should be watered in such a manner as to totally saturate the soil in the root zone area, to a depth of 6 inches. Once established, perennials shall continue to be watered as necessary to maintain them in a vigorous healthy condition. Over-watering or constant saturation of the soil must be avoided as this could lead to root rot and other disease problems. The use of a soil moisture meter can help you monitor the soil's water intake.

On-site water shall be furnished by the Owner. Hose and other watering equipment shall be furnished by the Landscape Maintenance Contractor.

Replacement – Any unhealthy plant/s that may cause widespread infestation of other nearby plants shall be immediately removed from the site. Any vegetation removed from the site must be recorded and submitted with the landscape maintenance log. The area shall be treated to prevent further infestation. The plant/s shall then be replaced with healthy

specimen/s of the same species and size. Old Forge shall have a pre-established budget allowance for this type of replacement, each year.

Plant material that is damaged as a result of other landscape maintenance activities, such as mowing, shall be replaced with healthy specimens of the same species and size, at no additional cost to the owner.

Deadheading – Perennials shall be checked on a weekly basis and dead-headed once flowers have faded or as necessary based on plant type and duration of flower. Spent flowers can be pinched off with the thumb and forefinger. Continue to remove all faded flowers until Fall. All associated debris shall be removed from site daily.

Staking – Upright-growing perennials need support especially when in flower. Use of bamboo stakes, galvanized wire hoops or mesh may be necessary for their support. Supports should be put in place before they have become too difficult to handle. The supports should not be taller than the mature height of the perennial plant.

Division of Perennials – Two or three-year-old perennials are easily divided in the spring if more plants are needed. To divide, cut out the entire section of plant to be divided, including roots. The larger divisions (those with three or more shoots), can be set out immediately in their permanent location, where they can be expected to bloom the same season. Smaller divisions are best planted in an out-of-the-way planting bed until the following autumn or spring, when they can be moved to their permanent location.

Weeding – All planting beds should be kept weed-free. Weed either by hand or with a pre-emergent herbicide such as Treflen used according to manufacturers' specifications. Manual weeding is to be used in combination with the use of spot applications of herbicides. Both live and dead weeds are to be pulled and removed from the site.

All herbicide applications shall be documented in the Landscape Maintenance Log. The actual product label or the manufacturer's product specification sheet for the specific product shall also be included in the Log.

Only personnel with appropriate applicator licenses shall supervise and/or perform the application of pesticide products requiring a license.

Winterizing – Perennial gardens should be cleaned-up when growth ceases in the fall. Remove foliage of plants that normally die down to the ground. Divide and replant over-grown clumps.

C. Lawn Areas - Turf Systems

Mowing – Proper mowing is an integral part of any good turf maintenance program. Without it, the finest in fertilization, watering and other vital maintenance practices would be completely ineffective. Proper mowing will help control dicot weeds; help the turf survive during periods of extreme heat, and gain strength and vigor to resist disease and other infestations.

Mowing height – The proper mowing height will vary somewhat according to the type of grass. The most common type of seed & sod lawns contain a mixture of bluegrass, fine fescue and perennial rye, which should be mowed at 2-3 inches.

Mowing frequency – The basic rule of thumb for mowing frequency is to never remove more than 1/3 of the grass blade in one mowing. Example: if you want to mow your turf at 2 inches, you should cut it when it reaches 3 inches. Removing more than ½ of the grass plant at a time can put the plant into shock, thus making it more susceptible to stress disease and weed infestation.

Mowing frequency will vary with the growing season and should be set by the plant height and not a set date. It will often be necessary to mow twice a week during periods of surge growth to help maintain plant health and color. Mowing should be cut back during periods of stress.

Grass clippings should be removed whenever they are thick enough to layer the turf. The return of clippings to the soil actually adds nutrients and helps retain moisture. Heavily clumped grass clippings are a sign of infrequent mowing, calling for an adjustment in the mowing schedule.

When mowing any area, try to alternate mowing patterns. This tends to keep grass blades more erect and assures an even cut. A dull mower will cause color loss due to tearing of the turf plant, and since mowing will ultimately determine the appearance of any turf area there is an absolute necessity for a clean sharp cut.

Weed & Pest Control and Fertilizing- In order to maintain turf grass health, vigor color, and nutrients, fertilizer must be added to the soil. Recommendations for fertilization of lawn areas are as follows; fertilize at the rate of one (1) pound of nitrogen per thousand square feet, per year is optimum. Fertilizer should be a balanced slow release, sulfur coated type fertilizer.

Weed Control - All turf areas will require some weed control, for both weed grasses and dicot weeds. Weeds should be treated at the appropriate time and with a material labeled for the target weed. Please refer to the fertilizer weed and pest schedule for timing.

Pest Control - All turf areas will require some pest control. Pests should be treated at the appropriate time with a material labeled for the target pest. Please refer to the fertilizer, weed and pest schedule for timing.

Lime - A common cause for an unhealthy lawn is acidic soil. When the pH is below the neutral range (between 6-7) vital plant nutrients become fixed in the soil and cannot be absorbed by the grass plant. Lime corrects an acid soil condition, supplies calcium for plant growth and improves air and water circulation. Limestone applied at the rate of 50 lbs. per thousand square feet will adjust the soil pH one point over a period of 6-9 months.

D. Fertilizer, Weed & Pest Control Schedule – Turf Systems

Spring - (April)	Fertilize one (1) pound of nitrogen per 1,000 square feet Pre-emergent weed grass control Broadleaf weed control
Late Spring - (June)	Fertilize one (1) pound of nitrogen per 1,000 square feet Pre-emergent weed grass control Broadleaf weed control Insect Control (if needed)
*Summer - (August)	Fertilize one (1) pound of nitrogen per 1,000 square feet Broadleaf weed control (if needed) Insect Control (if needed)
Fall - (September)	Fertilize one (1) pound of nitrogen per 1,000 square feet

*Omit if area is not to be irrigated

Lawn Maintenance Task Schedule

MARCH (Weather permitting)
- Clean up winter debris, sand, leaves, trash etc.
- Re-edge mulch beds, maintain at 2-3” maximum.
- Fertilize plants
- Aerate and thatch turf (conditions permitting)

APRIL
- Reseed or sod all areas needing attention.
- Fertilize and weed control

- Lime
- Start mowing when grass reaches 2-1/2", mow to 2"

MAY
- Mow turf to 2-2-1/2"
- Weed as necessary.
- Check for disease and pest problems in both turf and plants.

JUNE
- Mow turf to 2-1/2" – 3"
- Fertilize and weed control.
- Weed
- Check for disease and pest problems in both turf and plants, treat as necessary.

Provisions for Solid Waste Management (Site Trash)

Trash will be placed in on-site dumpsters and the Owner will make provisions for its regular and timely removal.

Snow Disposal and Plowing Plans

The purpose of the snow and snowmelt management plan is to provide guidelines regarding snow disposal site selection, site preparation and maintenance that are acceptable to the Department of Environmental Protection. For the areas that require snow removal, snow storage onsite will largely be accomplished by using pervious areas along the shoulder of the roadway and development as windrowed by plows.

- Avoid dumping of snow into any water body, including rivers, ponds, or wetlands. In addition to water quality impacts and flooding, snow disposed of in open water can cause navigational hazards when it freezes into ice blocks.
- Avoid disposing of snow on top of storm drain catch basins or in stormwater basins. Snow combined with sand and debris may block a storm drainage system, causing localized flooding. A high volume of sand, sediment, and litter released from melting snow also may be quickly transported through the system into surface water.
- In significant storm events, the melting or off-site trucking of snow may be implemented. These activities shall be conducted in accordance with all local, state and federal regulations.
- Snow shall be removed from the areas around on-site fire-hydrants to maintain emergency access to hydrants at all times. Removable flags or markers should be placed on hydrants to allow snow removal crews to more easily locate hydrants and not damage them with plows or other snow removal equipment.

Winter Road Salt and/or Sand Use and Storage Restrictions

The applicant will be responsible for sanding and salting the site. No storage on site.

Street Sweeping Schedules

There are three types of sweepers: Mechanical, Regenerative Air, and Vacuum Filter.

1) Mechanical: Mechanical sweepers use brooms or rotary brushes to scour the pavement.
2) Regenerative Air: These sweepers blow air onto the road or parking lot surface, causing fines to rise where they are vacuumed.
3) Vacuum filter: These sweepers remove fines along roads. Two general types of vacuum filter sweepers are available - wet and dry. The dry type uses a broom in combination with the vacuum. The wet type uses water for dust suppression

Regardless of the type chosen, the efficiency of street sweeping is increased when sweepers are operated in tandem.

This project has not included street sweeping as part of the TSS removal calculations. However, it is recommended that street sweeping of the parking areas occur four times a year, including once after the spring snow melt.

Reuse and Disposal of Street Sweepings

Once removed from paved surfaces, the sweepings must be handled and disposed of properly. Mass DEP's Bureau of Waste Prevention has issued a written policy regarding the reuse and disposal of street sweepings. These sweepings are regulated as a solid waste, and can be used in three ways:

- In one of the ways already approved by Mass DEP (e.g., daily cover in a landfill, additive to compost, fill in a public way)
- If approved under a Beneficial Use Determination
- Disposed in a landfill

TRAINING OF STAFF OR PERSONNEL INVOLVED WITH IMPLEMENTING LONG-TERM POLLUTION PREVENTION PLAN

The Long-Term Pollution Prevention Plan is to be implemented by property owner of the site. Trained and, if required, licensed Professionals are to be hired by the owner as applicable to implement the Long-Term Pollution Prevention Plan.

LIST OF EMERGENCY CONTACTS FOR IMPLEMENTING LONG-TERM POLLUTION PREVENTION PLAN

The applicant will be required to implement the Long-Term Pollution Prevention Plan and will create and maintain a list of emergency contacts.

ESTIMATED OPERATION AND MAINTENANCE BUDGET

An estimated operation and maintenance budget in accordance with the schedule for inspections and routine maintenance in for each BMP above is as follows:

Stormwater BMP	**Maintenance Schedule**	**Cost per Cleaning /Inspection**	**Total Cost (per year)**
Catch Basins	4 times per year	$500	$2,000
Water Quality Units	Twice per year and after major storm events	$500	$1,000
Infiltration Systems	Twice per year and after major storm events	$2500	$5,000
Inspections	Annual	$1000	$1,000
Total Annual Cost			**$9,000**

POST CONSTRUCTION PHASE INSPECTION SCHEDULE AND EVALUATION CHECKLIST

Inspection Date	Inspector	BMP Inspected	Inspection Frequency Requirements	Comments	Recommendation	Follow-up Inspection Required (yes/no)
		Catch Basin	Four times a year			
		Water Quality Units	Four times a year			
		Infiltration System	Twice a year			
		Pipe Outlet Protection	Once a year			

1. Refer to the Massachusetts Stormwater Handbook Volume Two: Stormwater Technical Handbook (February 2008) for recommendations regarding frequency for inspections and maintenance of specific BMP's

2. Inspections to be conducted by a qualified professional such as an environmental scientist or civil engineer.

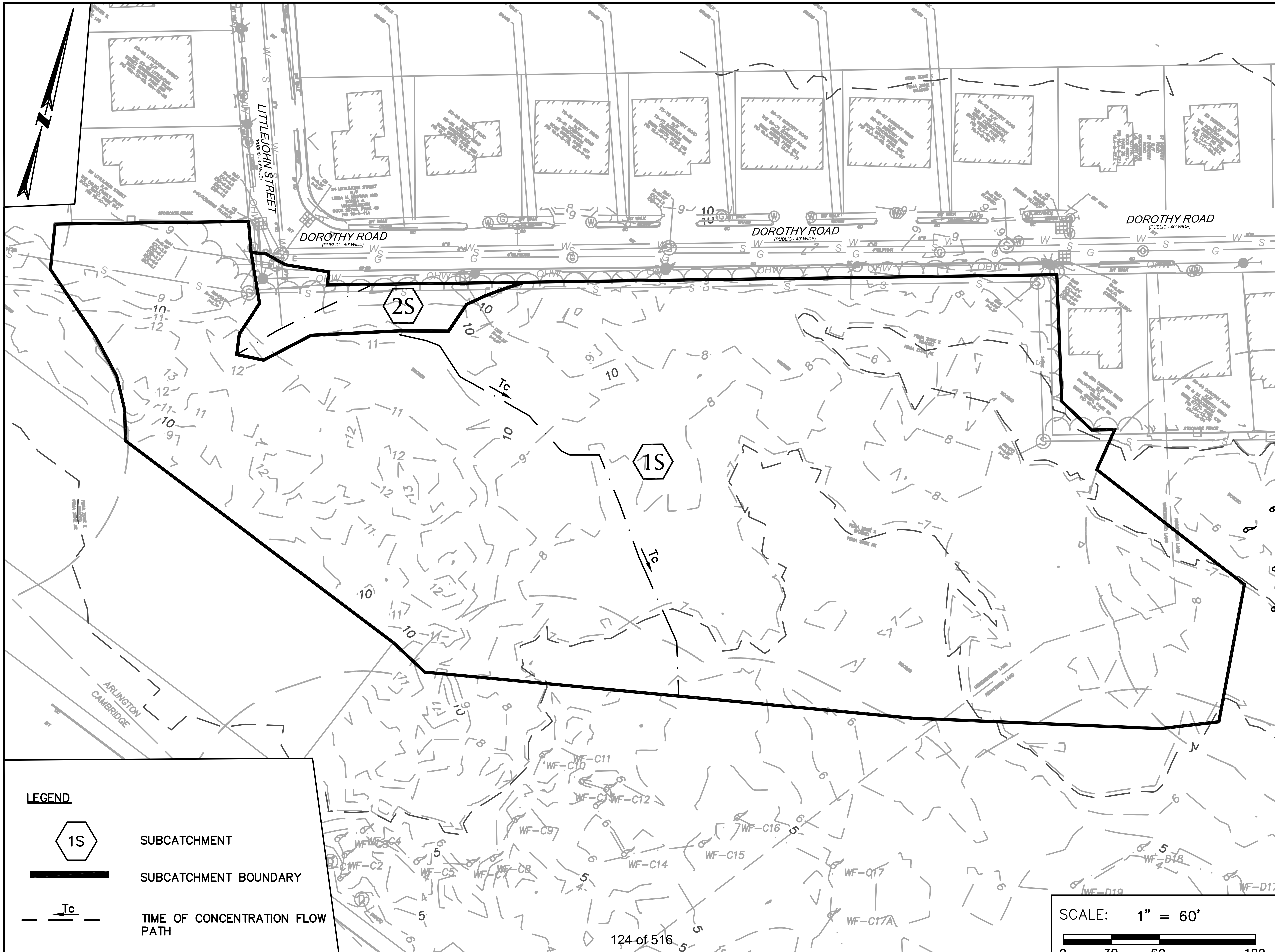
3. Limited or no use of sodium chloride salts, fertilizers or pesticides recommended.

4. Other Notes: (Include deviations from Conservation Commission Approvals, Planning Board Approvals and Approved Plans)

SECTION 5.0

HYDROLOGY CALCULATIONS

5.01 EXISTING WATERSHED PLAN



LEGEND

1S	SUBCATCHMENT
	SUBCATCHMENT BOUNDARY
Tc	TIME OF CONCENTRATION FLOW PATH

SCALE: 1" = 60'

0 30 60 120FEET

THORNDIKE PLACE

DOROTHY ROAD

ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

EXISTING WATERSHED PLAN

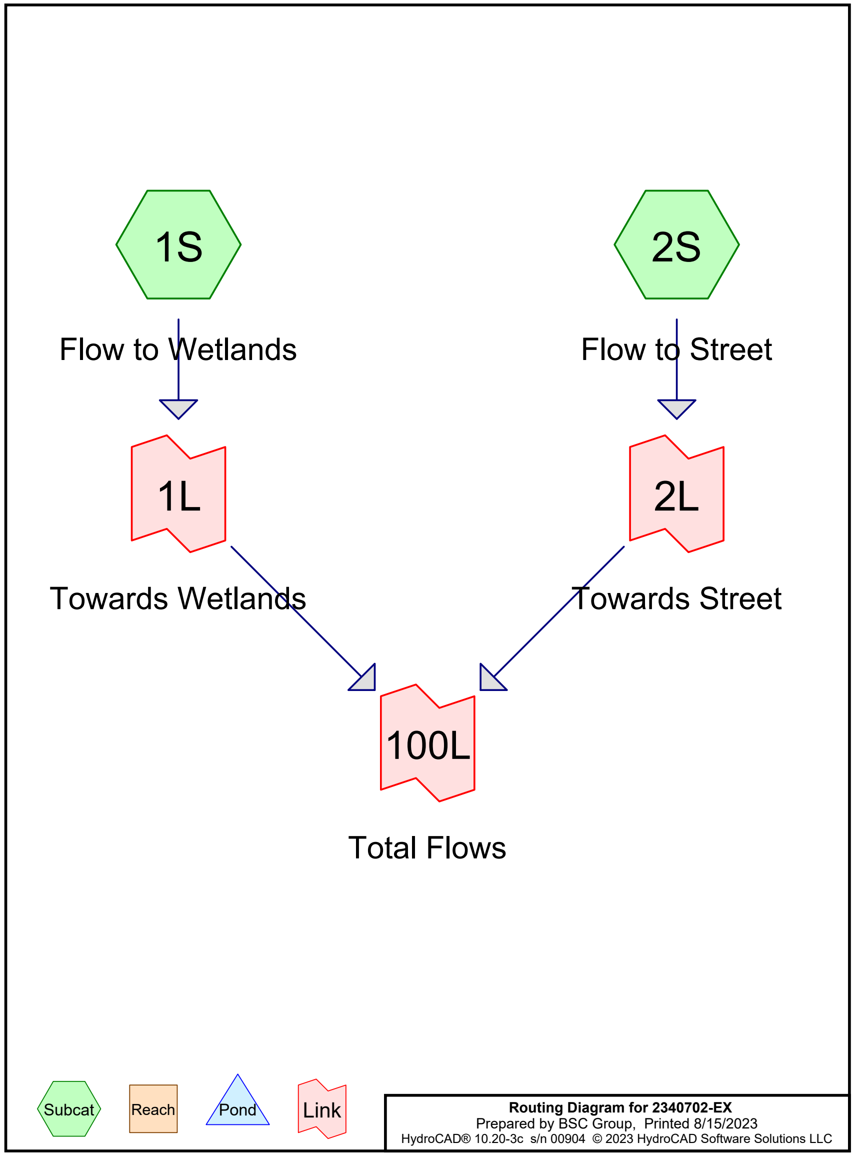
NOVEMBER 3, 2020

PREPARED FOR:
ARLINGTON LAND REALTY
84 SHERMAN STREET
CAMBRIDGE, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

Job No.: 23407.00
Date: 11/3/2020
Scale: 1" = 60'
Revised: 08/18/2021
Dwg No: EXW
File: C:\DRAINAGE DESIGN\2340700-EXW

5.02 EXISTING HYDROLOGY CALCULATIONS (HYDROCAD™ PRINTOUTS)



Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
925	98	Paved parking, HSG C (2S)
157,761	70	Woods, Good, HSG C (1S, 2S)
158,686	**70**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
158,686	HSG C	1S, 2S
0	HSG D	
0	Other	
158,686		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchment Numbers
0	0	925	0	0	925	Paved parking	2S
0	0	157,761	0	0	157,761	Woods, Good	1S, 2S
0	**0**	**158,686**	**0**	**0**	**158,686**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Flow to Wetlands Runoff Area=151,732 sf 0.00% Impervious Runoff Depth>1.34"
Flow Length=310' Tc=17.5 min CN=70 Runoff=3.7 cfs 16,903 cf

Subcatchment 2S: Flow to Street Runoff Area=6,954 sf 13.30% Impervious Runoff Depth>1.61"
Flow Length=95' Tc=6.0 min CN=74 Runoff=0.3 cfs 932 cf

Link 1L: Towards Wetlands Inflow=3.7 cfs 16,903 cf
Primary=3.7 cfs 16,903 cf

Link 2L: Towards Street Inflow=0.3 cfs 932 cf
Primary=0.3 cfs 932 cf

Link 100L: Total Flows Inflow=3.8 cfs 17,836 cf
Primary=3.8 cfs 17,836 cf

Total Runoff Area = 158,686 sf Runoff Volume = 17,836 cf Average Runoff Depth = 1.35"
99.42% Pervious = 157,761 sf 0.58% Impervious = 925 sf

Summary for Subcatchment 1S: Flow to Wetlands

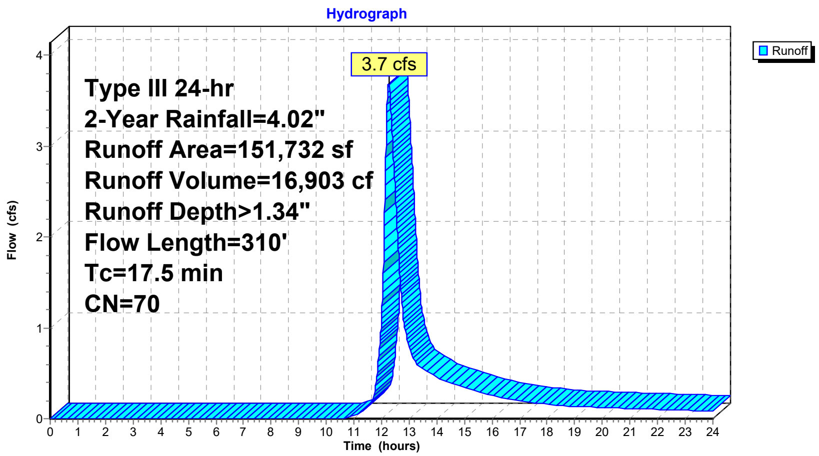
Runoff = 3.7 cfs @ 12.26 hrs, Volume= 16,903 cf, Depth> 1.34"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
151,732	70	Woods, Good, HSG C
151,732		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	50	0.0240	0.07		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.23"
6.1	260	0.0200	0.71		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
17.5	310	Total			

Subcatchment 1S: Flow to Wetlands



Summary for Subcatchment 2S: Flow to Street

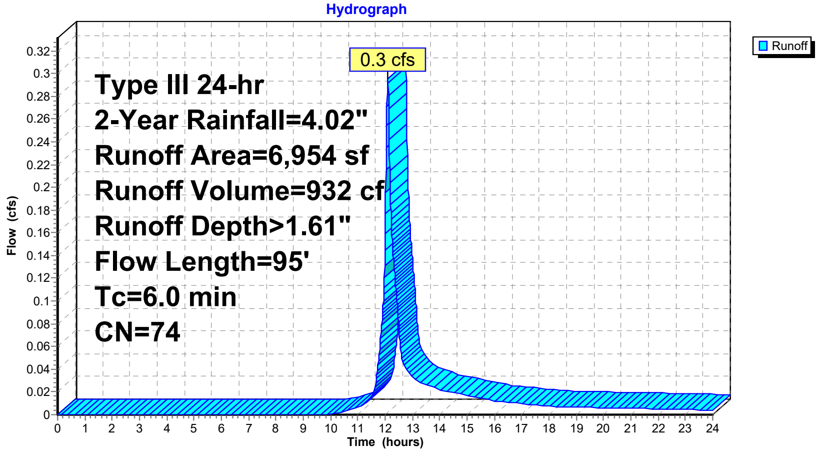
Runoff = 0.3 cfs @ 12.09 hrs, Volume= 932 cf, Depth> 1.61"
Routed to Link 2L : Towards Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
6,029	70	Woods, Good, HSG C
925	98	Paved parking, HSG C
6,954	74	Weighted Average
6,029		86.70% Pervious Area
925		13.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	20	0.0750	0.10		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.23"
1.8	75	0.0200	0.71		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
5.3	95	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2S: Flow to Street

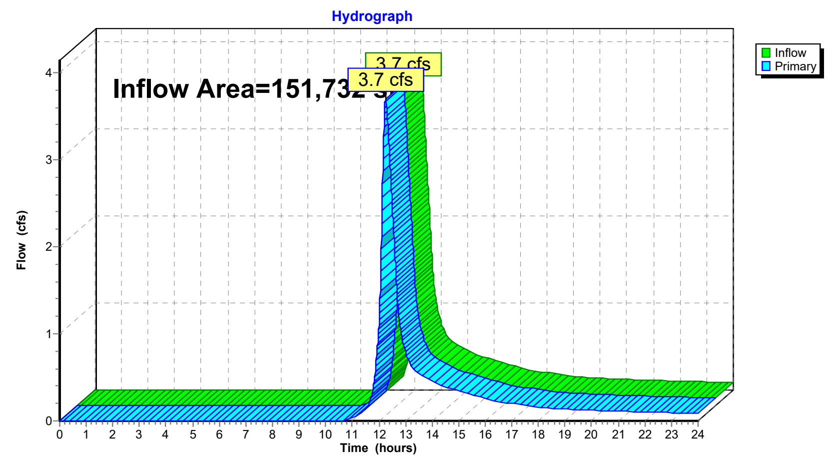


Summary for Link 1L: Towards Wetlands

Inflow Area = 151,732 sf, 0.00% Impervious, Inflow Depth > 1.34" for 2-Year event
Inflow = 3.7 cfs @ 12.26 hrs, Volume= 16,903 cf
Primary = 3.7 cfs @ 12.26 hrs, Volume= 16,903 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 1L: Towards Wetlands

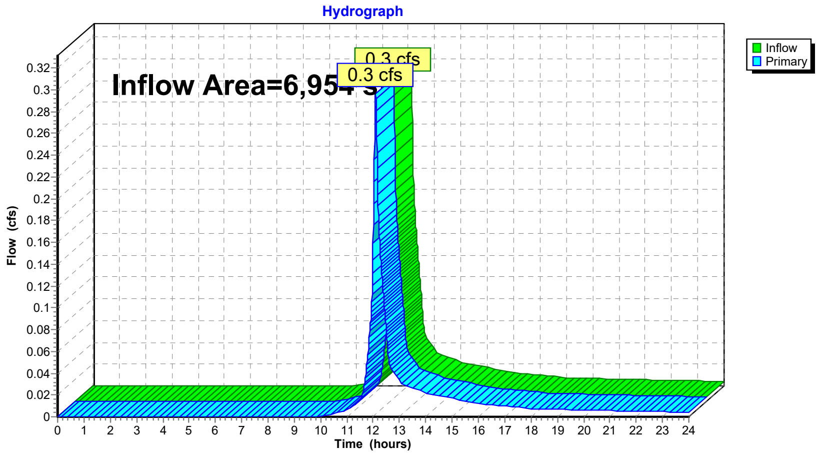


Summary for Link 2L: Towards Street

Inflow Area = 6,954 sf, 13.30% Impervious, Inflow Depth > 1.61" for 2-Year event
Inflow = 0.3 cfs @ 12.09 hrs, Volume= 932 cf
Primary = 0.3 cfs @ 12.09 hrs, Volume= 932 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 2L: Towards Street

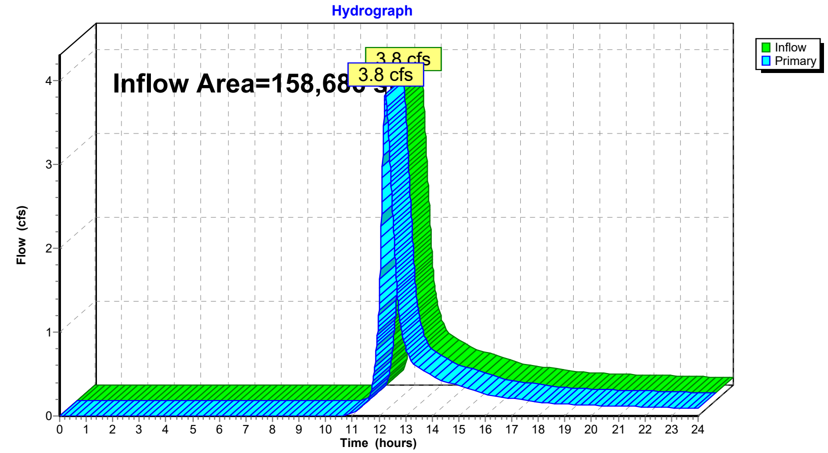


Summary for Link 100L: Total Flows

Inflow Area = 158,686 sf, 0.58% Impervious, Inflow Depth > 1.35" for 2-Year event
Inflow = 3.8 cfs @ 12.26 hrs, Volume= 17,836 cf
Primary = 3.8 cfs @ 12.26 hrs, Volume= 17,836 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 100L: Total Flows



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Flow to Wetlands Runoff Area=151,732 sf 0.00% Impervious Runoff Depth>3.11"
Flow Length=310' Tc=17.5 min CN=70 Runoff=9.0 cfs 39,374 cf

Subcatchment 2S: Flow to Street Runoff Area=6,954 sf 13.30% Impervious Runoff Depth>3.52"
Flow Length=95' Tc=6.0 min CN=74 Runoff=0.7 cfs 2,040 cf

Link 1L: Towards Wetlands Inflow=9.0 cfs 39,374 cf
Primary=9.0 cfs 39,374 cf

Link 2L: Towards Street Inflow=0.7 cfs 2,040 cf
Primary=0.7 cfs 2,040 cf

Link 100L: Total Flows Inflow=9.4 cfs 41,414 cf
Primary=9.4 cfs 41,414 cf

Total Runoff Area = 158,686 sf Runoff Volume = 41,414 cf Average Runoff Depth = 3.13"
99.42% Pervious = 157,761 sf 0.58% Impervious = 925 sf

Summary for Subcatchment 1S: Flow to Wetlands

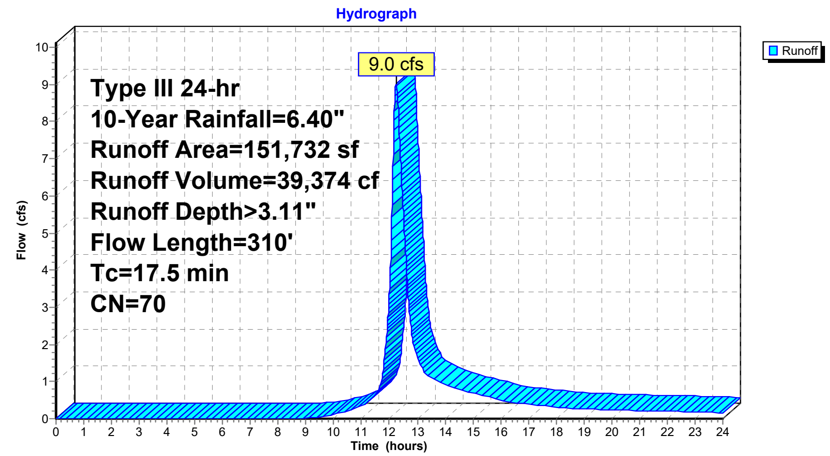
Runoff = 9.0 cfs @ 12.24 hrs, Volume= 39,374 cf, Depth> 3.11"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
151,732	70	Woods, Good, HSG C
151,732		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	50	0.0240	0.07		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.23"
6.1	260	0.0200	0.71		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
17.5	310	Total			

Subcatchment 1S: Flow to Wetlands



Summary for Subcatchment 2S: Flow to Street

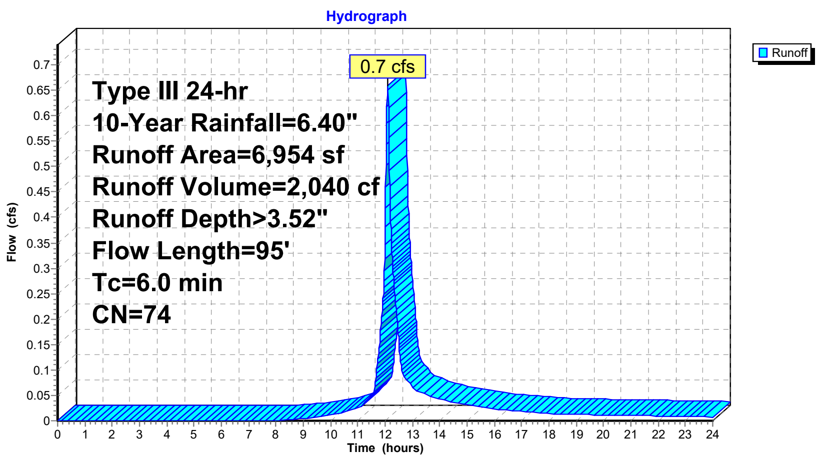
Runoff = 0.7 cfs @ 12.09 hrs, Volume= 2,040 cf, Depth> 3.52"
Routed to Link 2L : Towards Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
6,029	70	Woods, Good, HSG C
925	98	Paved parking, HSG C
6,954	74	Weighted Average
6,029		86.70% Pervious Area
925		13.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	20	0.0750	0.10		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.23"
1.8	75	0.0200	0.71		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
5.3	95	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2S: Flow to Street

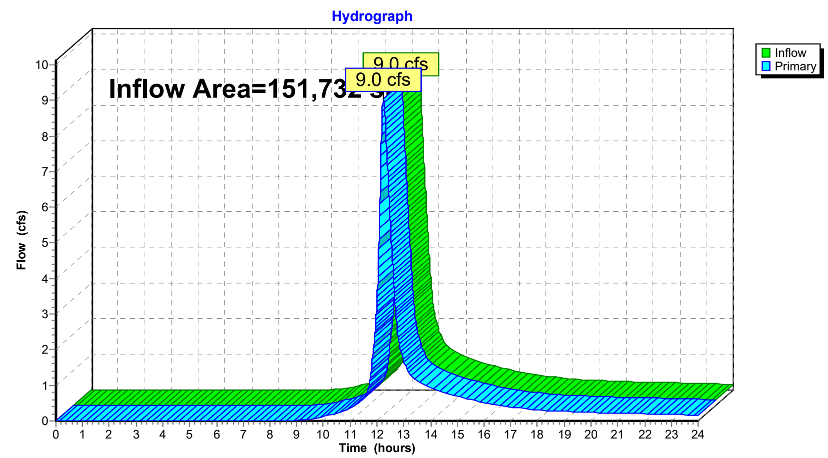


Summary for Link 1L: Towards Wetlands

Inflow Area = 151,732 sf, 0.00% Impervious, Inflow Depth > 3.11" for 10-Year event
Inflow = 9.0 cfs @ 12.24 hrs, Volume= 39,374 cf
Primary = 9.0 cfs @ 12.24 hrs, Volume= 39,374 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 1L: Towards Wetlands

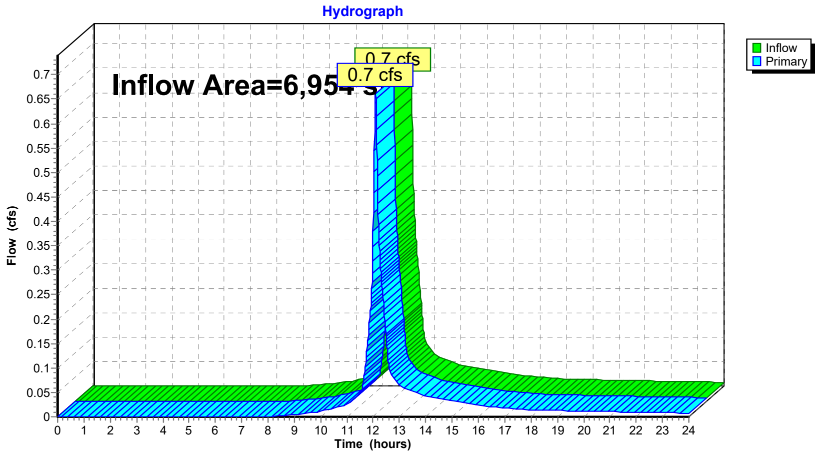


Summary for Link 2L: Towards Street

Inflow Area = 6,954 sf, 13.30% Impervious, Inflow Depth > 3.52" for 10-Year event
Inflow = 0.7 cfs @ 12.09 hrs, Volume= 2,040 cf
Primary = 0.7 cfs @ 12.09 hrs, Volume= 2,040 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 2L: Towards Street

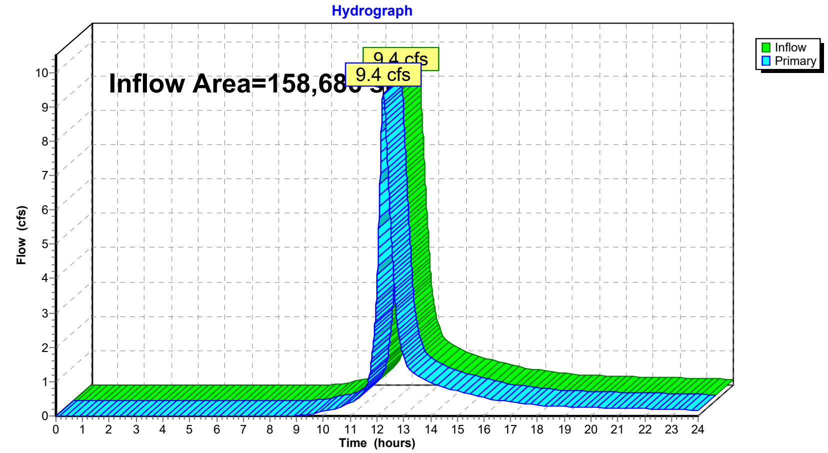


Summary for Link 100L: Total Flows

Inflow Area = 158,686 sf, 0.58% Impervious, Inflow Depth > 3.13" for 10-Year event
Inflow = 9.4 cfs @ 12.24 hrs, Volume= 41,414 cf
Primary = 9.4 cfs @ 12.24 hrs, Volume= 41,414 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 100L: Total Flows



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Flow to Wetlands Runoff Area=151,732 sf 0.00% Impervious Runoff Depth>4.71"
Flow Length=310' Tc=17.5 min CN=70 Runoff=13.7 cfs 59,512 cf

Subcatchment 2S: Flow to Street Runoff Area=6,954 sf 13.30% Impervious Runoff Depth>5.19"
Flow Length=95' Tc=6.0 min CN=74 Runoff=1.0 cfs 3,007 cf

Link 1L: Towards Wetlands Inflow=13.7 cfs 59,512 cf
Primary=13.7 cfs 59,512 cf

Link 2L: Towards Street Inflow=1.0 cfs 3,007 cf
Primary=1.0 cfs 3,007 cf

Link 100L: Total Flows Inflow=14.2 cfs 62,519 cf
Primary=14.2 cfs 62,519 cf

Total Runoff Area = 158,686 sf Runoff Volume = 62,519 cf Average Runoff Depth = 4.73"
99.42% Pervious = 157,761 sf 0.58% Impervious = 925 sf

2340702-EX *Type III 24-hr 25-Year Rainfall=8.30"*
Prepared by BSC Group Printed 8/15/2023
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Summary for Subcatchment 1S: Flow to Wetlands

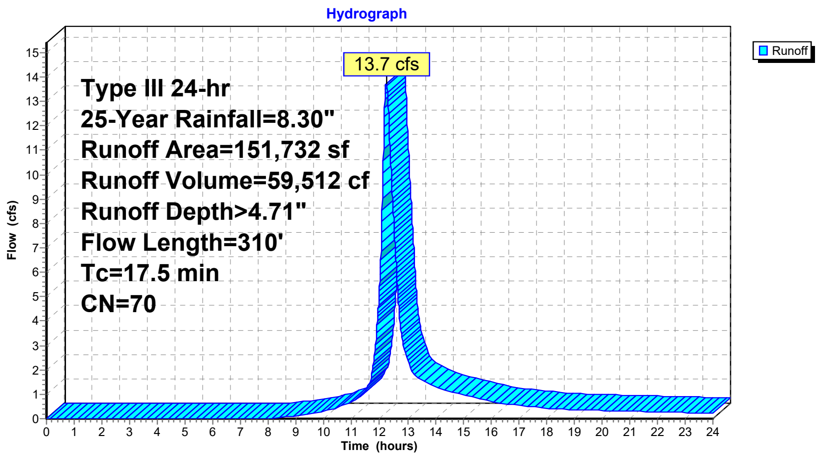
Runoff = 13.7 cfs @ 12.23 hrs, Volume= 59,512 cf, Depth> 4.71"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
151,732	70	Woods, Good, HSG C
151,732		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	50	0.0240	0.07		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.23"
6.1	260	0.0200	0.71		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
17.5	310	Total			

Subcatchment 1S: Flow to Wetlands



Summary for Subcatchment 2S: Flow to Street

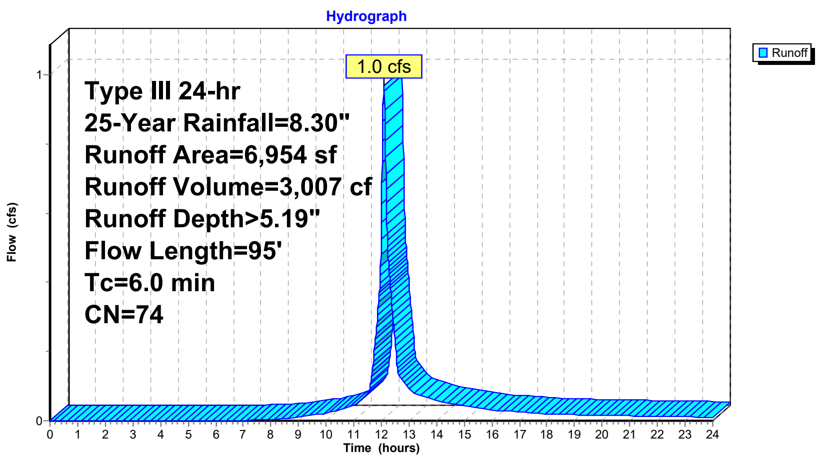
Runoff = 1.0 cfs @ 12.09 hrs, Volume= 3,007 cf, Depth> 5.19"
Routed to Link 2L : Towards Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
6,029	70	Woods, Good, HSG C
925	98	Paved parking, HSG C
6,954	74	Weighted Average
6,029		86.70% Pervious Area
925		13.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	20	0.0750	0.10		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.23"
1.8	75	0.0200	0.71		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
5.3	95	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2S: Flow to Street

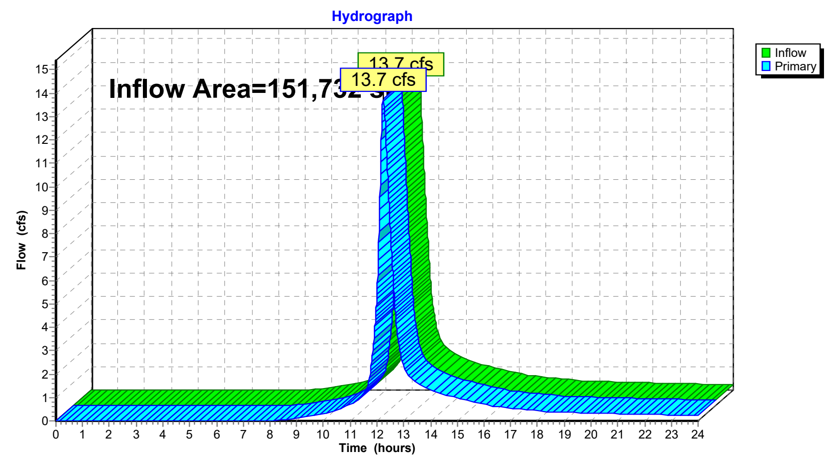


Summary for Link 1L: Towards Wetlands

Inflow Area = 151,732 sf, 0.00% Impervious, Inflow Depth > 4.71" for 25-Year event
Inflow = 13.7 cfs @ 12.23 hrs, Volume= 59,512 cf
Primary = 13.7 cfs @ 12.23 hrs, Volume= 59,512 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 1L: Towards Wetlands

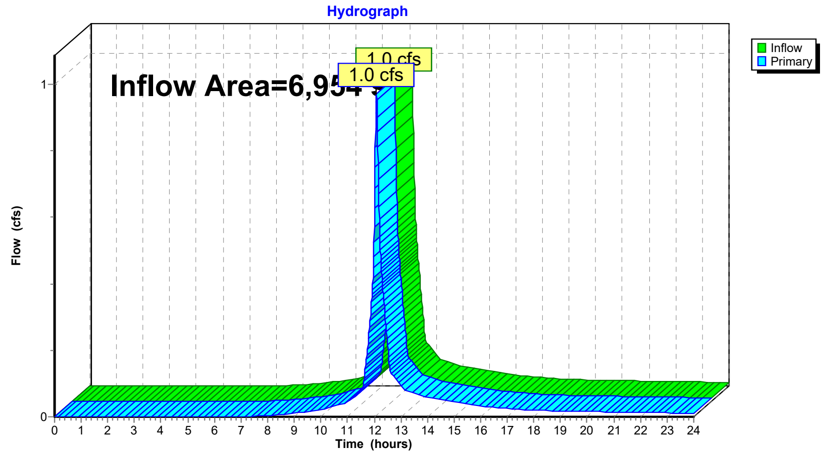


Summary for Link 2L: Towards Street

Inflow Area = 6,954 sf, 13.30% Impervious, Inflow Depth > 5.19" for 25-Year event
Inflow = 1.0 cfs @ 12.09 hrs, Volume= 3,007 cf
Primary = 1.0 cfs @ 12.09 hrs, Volume= 3,007 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 2L: Towards Street

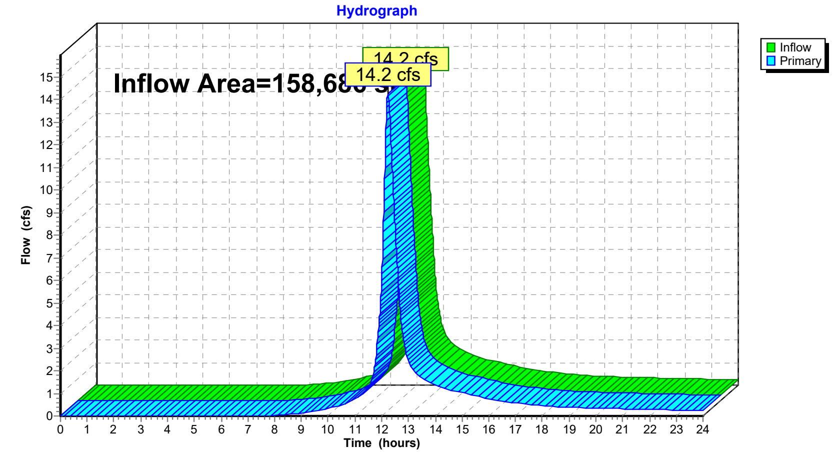


Summary for Link 100L: Total Flows

Inflow Area = 158,686 sf, 0.58% Impervious, Inflow Depth > 4.73" for 25-Year event
Inflow = 14.2 cfs @ 12.23 hrs, Volume= 62,519 cf
Primary = 14.2 cfs @ 12.23 hrs, Volume= 62,519 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 100L: Total Flows



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Flow to Wetlands Runoff Area=151,732 sf 0.00% Impervious Runoff Depth>5.91"
Flow Length=310' Tc=17.5 min CN=70 Runoff=17.2 cfs 74,721 cf

Subcatchment 2S: Flow to Street Runoff Area=6,954 sf 13.30% Impervious Runoff Depth>6.44"
Flow Length=95' Tc=6.0 min CN=74 Runoff=1.2 cfs 3,730 cf

Link 1L: Towards Wetlands Inflow=17.2 cfs 74,721 cf
Primary=17.2 cfs 74,721 cf

Link 2L: Towards Street Inflow=1.2 cfs 3,730 cf
Primary=1.2 cfs 3,730 cf

Link 100L: Total Flows Inflow=17.9 cfs 78,451 cf
Primary=17.9 cfs 78,451 cf

Total Runoff Area = 158,686 sf Runoff Volume = 78,451 cf Average Runoff Depth = 5.93"
99.42% Pervious = 157,761 sf 0.58% Impervious = 925 sf

Summary for Subcatchment 1S: Flow to Wetlands

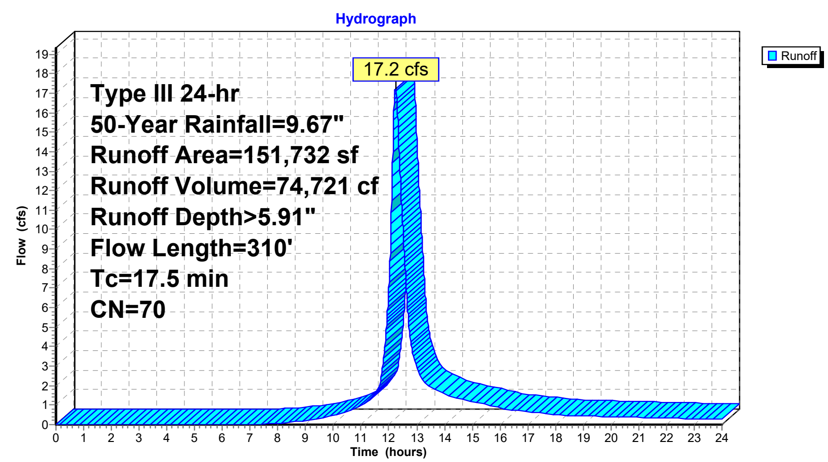
Runoff = 17.2 cfs @ 12.23 hrs, Volume= 74,721 cf, Depth> 5.91"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
151,732	70	Woods, Good, HSG C
151,732		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	50	0.0240	0.07		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.23"
6.1	260	0.0200	0.71		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
17.5	310	Total			

Subcatchment 1S: Flow to Wetlands



Summary for Subcatchment 2S: Flow to Street

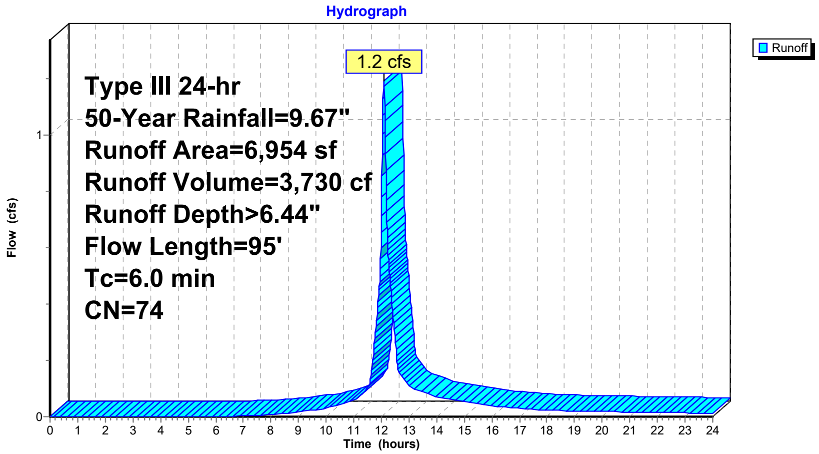
Runoff = 1.2 cfs @ 12.09 hrs, Volume= 3,730 cf, Depth> 6.44"
Routed to Link 2L : Towards Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
6,029	70	Woods, Good, HSG C
925	98	Paved parking, HSG C
6,954	74	Weighted Average
6,029		86.70% Pervious Area
925		13.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	20	0.0750	0.10		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.23"
1.8	75	0.0200	0.71		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
5.3	95	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2S: Flow to Street

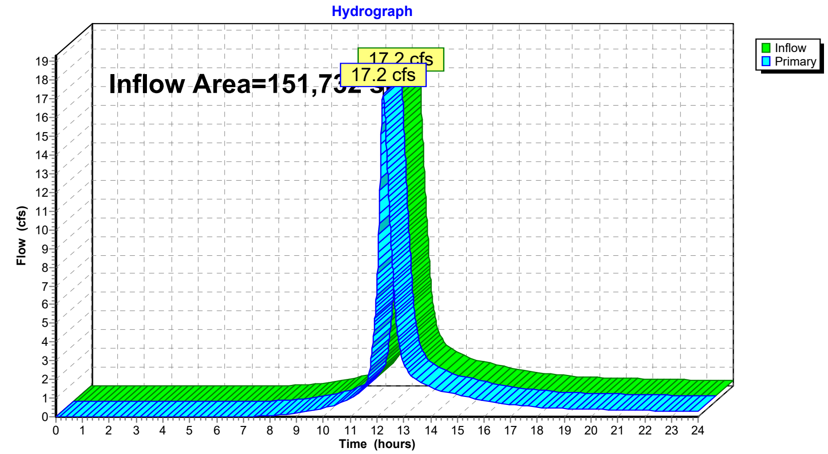


Summary for Link 1L: Towards Wetlands

Inflow Area = 151,732 sf, 0.00% Impervious, Inflow Depth > 5.91" for 50-Year event
Inflow = 17.2 cfs @ 12.23 hrs, Volume= 74,721 cf
Primary = 17.2 cfs @ 12.23 hrs, Volume= 74,721 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 1L: Towards Wetlands

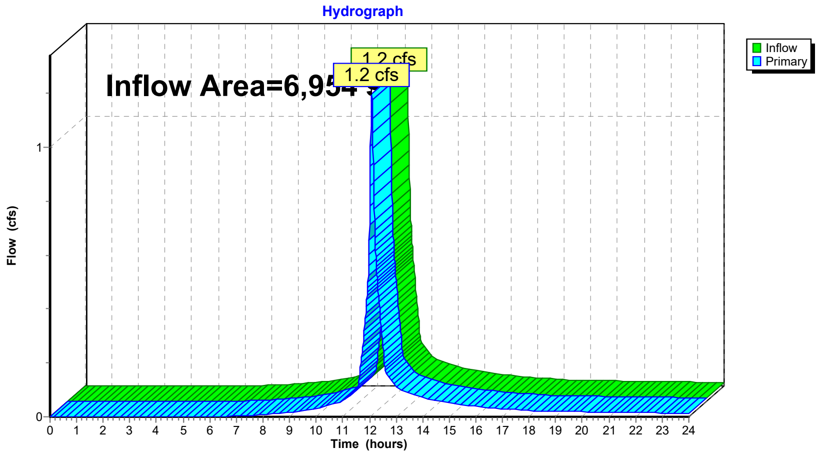


Summary for Link 2L: Towards Street

Inflow Area = 6,954 sf, 13.30% Impervious, Inflow Depth > 6.44" for 50-Year event
Inflow = 1.2 cfs @ 12.09 hrs, Volume= 3,730 cf
Primary = 1.2 cfs @ 12.09 hrs, Volume= 3,730 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 2L: Towards Street

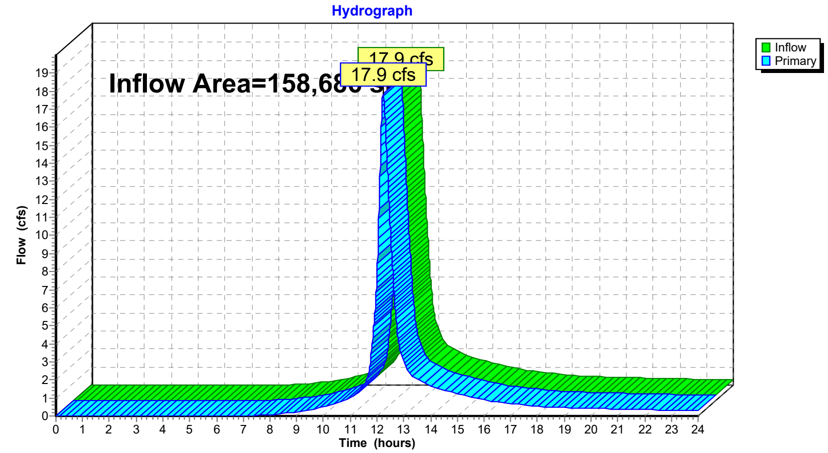


Summary for Link 100L: Total Flows

Inflow Area = 158,686 sf, 0.58% Impervious, Inflow Depth > 5.93" for 50-Year event
Inflow = 17.9 cfs @ 12.23 hrs, Volume= 78,451 cf
Primary = 17.9 cfs @ 12.23 hrs, Volume= 78,451 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 100L: Total Flows



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Flow to Wetlands Runoff Area=151,732 sf 0.00% Impervious Runoff Depth>7.56"
Flow Length=310' Tc=17.5 min CN=70 Runoff=22.0 cfs 95,631 cf

Subcatchment 2S: Flow to Street Runoff Area=6,954 sf 13.30% Impervious Runoff Depth>8.14"
Flow Length=95' Tc=6.0 min CN=74 Runoff=1.5 cfs 4,716 cf

Link 1L: Towards Wetlands Inflow=22.0 cfs 95,631 cf
Primary=22.0 cfs 95,631 cf

Link 2L: Towards Street Inflow=1.5 cfs 4,716 cf
Primary=1.5 cfs 4,716 cf

Link 100L: Total Flows Inflow=22.7 cfs 100,347 cf
Primary=22.7 cfs 100,347 cf

Total Runoff Area = 158,686 sf Runoff Volume = 100,347 cf Average Runoff Depth = 7.59"
99.42% Pervious = 157,761 sf 0.58% Impervious = 925 sf

Summary for Subcatchment 1S: Flow to Wetlands

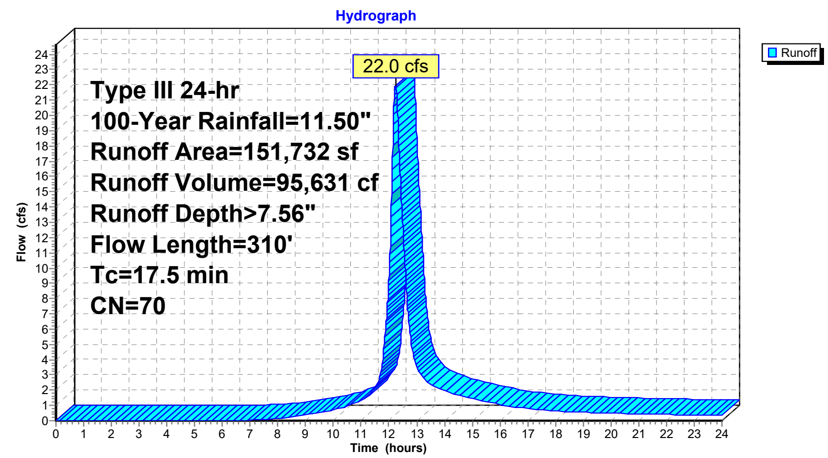
Runoff = 22.0 cfs @ 12.23 hrs, Volume= 95,631 cf, Depth> 7.56"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
151,732	70	Woods, Good, HSG C
151,732		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	50	0.0240	0.07		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.23"
6.1	260	0.0200	0.71		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
17.5	310	Total			

Subcatchment 1S: Flow to Wetlands



Summary for Subcatchment 2S: Flow to Street

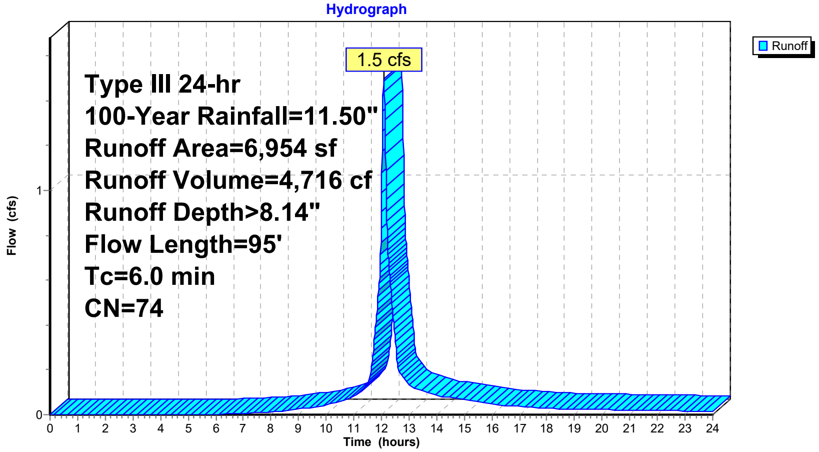
Runoff = 1.5 cfs @ 12.09 hrs, Volume= 4,716 cf, Depth> 8.14"
Routed to Link 2L : Towards Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
6,029	70	Woods, Good, HSG C
925	98	Paved parking, HSG C
6,954	74	Weighted Average
6,029		86.70% Pervious Area
925		13.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	20	0.0750	0.10		**Sheet Flow, A to B** Woods: Light underbrush n= 0.400 P2= 3.23"
1.8	75	0.0200	0.71		**Shallow Concentrated Flow, B to C** Woodland Kv= 5.0 fps
5.3	95	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 2S: Flow to Street

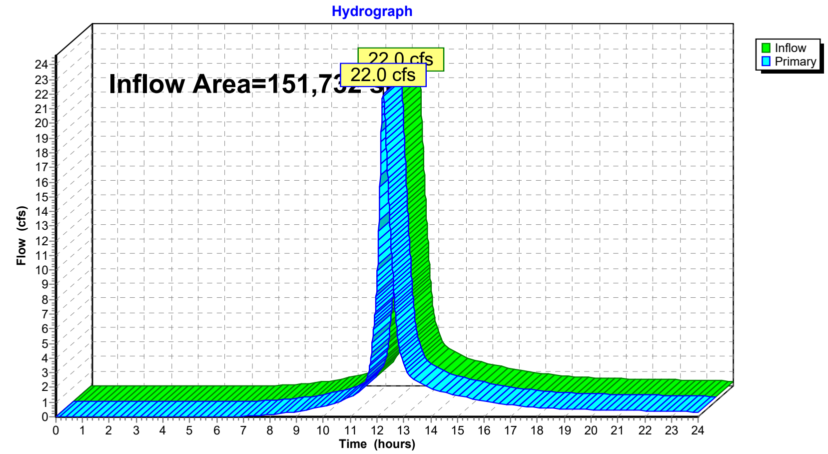


Summary for Link 1L: Towards Wetlands

Inflow Area = 151,732 sf, 0.00% Impervious, Inflow Depth > 7.56" for 100-Year event
Inflow = 22.0 cfs @ 12.23 hrs, Volume= 95,631 cf
Primary = 22.0 cfs @ 12.23 hrs, Volume= 95,631 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 1L: Towards Wetlands

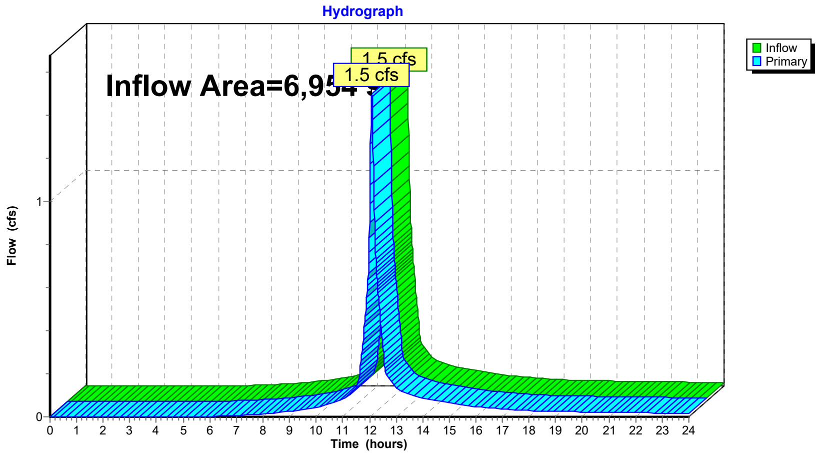


Summary for Link 2L: Towards Street

Inflow Area = 6,954 sf, 13.30% Impervious, Inflow Depth > 8.14" for 100-Year event
Inflow = 1.5 cfs @ 12.09 hrs, Volume= 4,716 cf
Primary = 1.5 cfs @ 12.09 hrs, Volume= 4,716 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 2L: Towards Street

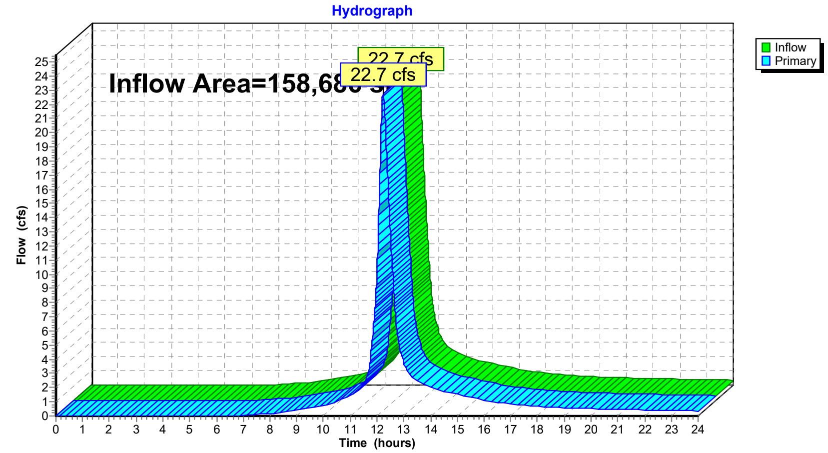


Summary for Link 100L: Total Flows

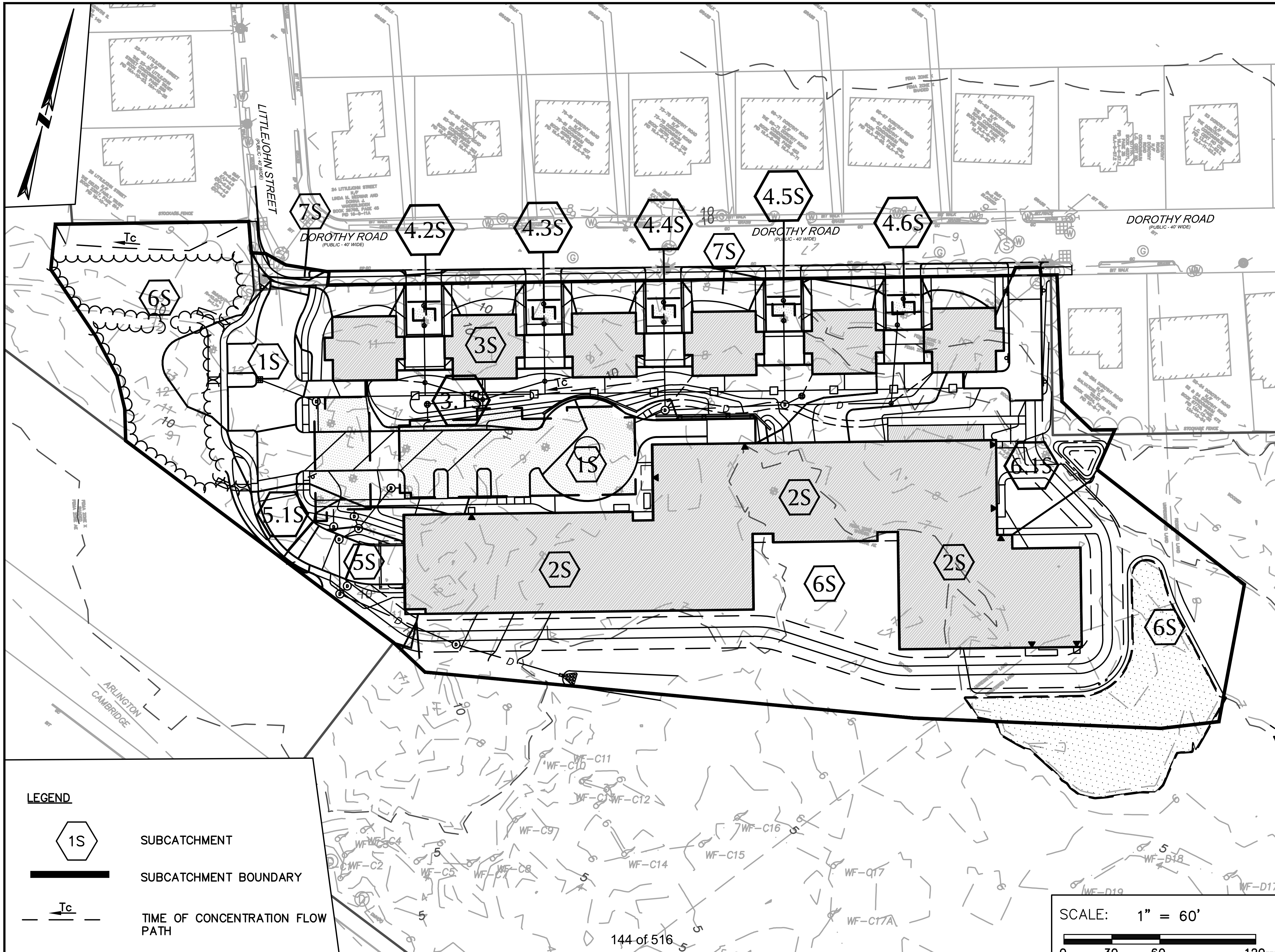
Inflow Area = 158,686 sf, 0.58% Impervious, Inflow Depth > 7.59" for 100-Year event
Inflow = 22.7 cfs @ 12.23 hrs, Volume= 100,347 cf
Primary = 22.7 cfs @ 12.23 hrs, Volume= 100,347 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link 100L: Total Flows



5.03 PROPOSED WATERSHED PLAN



THORNDIKE PLACE

DOROTHY ROAD

ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

PROPOSED WATERSHED PLAN

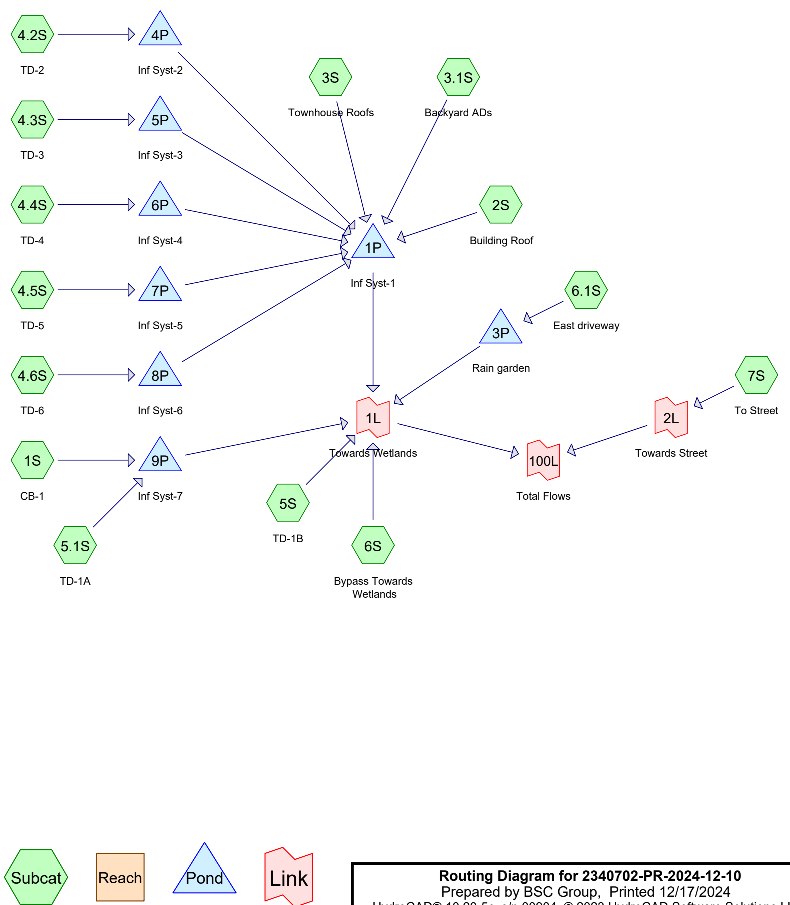
NOVEMBER 3, 2020

PREPARED FOR:
ARLINGTON LAND REALTY
84 SHERMAN STREET
CAMBRIDGE, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

Job No.: 23407.02 Date: 11/3/2020
Scale: 1" = 60' Revised: 12/10/2024
Dwg No: PRW
File: C\DRAINAGE DESIGN\2340700-PRW

5.04 Proposed Hydrology Calculations (HydroCAD™ Printouts)



Routing Diagram for 2340702-PR-2024-12-10
Prepared by BSC Group, Printed 12/17/2024
HydroCAD® 10.20-5c s/n 00904 © 2023 HydroCAD Software Solutions LLC

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	4.02	2
2	10-Year	Type III 24-hr		Default	24.00	1	6.40	2
3	25-Year	Type III 24-hr		Default	24.00	1	8.30	2
4	50-Year	Type III 24-hr		Default	24.00	1	9.67	2
5	100-Year	Type III 24-hr		Default	24.00	1	11.50	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
74,381	74	>75% Grass cover, Good, HSG C (1S, 3.1S, 4.2S, 4.3S, 4.4S, 4.5S, 4.6S, 5.1S, 5S, 6.1S, 6S, 7S)
220	89	Gravel roads, HSG C (6.1S)
411	89	Gravel sidewalk, HSG C (3.1S)
25,874	98	Paved parking, HSG C (1S, 4.2S, 4.3S, 4.4S, 4.5S, 4.6S, 5.1S, 5S, 7S)
6,444	98	Paved roads w/curbs & sewers, HSG C (6.1S)
46,099	98	Roofs, HSG C (2S, 3S, 6S)
272	98	Unconnected pavement, HSG C (3.1S)
4,985	70	Woods, Good, HSG C (6S)
158,686	**86**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
158,686	HSG C	1S, 2S, 3.1S, 3S, 4.2S, 4.3S, 4.4S, 4.5S, 4.6S, 5.1S, 5S, 6.1S, 6S, 7S
0	HSG D	
0	Other	
158,686		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
0	0	74,381	0	0	74,381	>75% Grass cover, Good
0	0	220	0	0	220	Gravel roads
0	0	411	0	0	411	Gravel sidewalk
0	0	25,874	0	0	25,874	Paved parking
0	0	6,444	0	0	6,444	Paved roads w/curbs & sewers
0	0	46,099	0	0	46,099	Roofs
0	0	272	0	0	272	Unconnected pavement
0	0	4,985	0	0	4,985	Woods, Good
0	**0**	**158,686**	**0**	**0**	**158,686**	**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: CB-1 Runoff Area=22,742 sf 72.16% Impervious Runoff Depth=3.04"
Tc=6.0 min CN=91 Runoff=1.8 cfs 5,755 cf

Subcatchment2S: Building Roof Runoff Area=32,925 sf 100.00% Impervious Runoff Depth=3.79"
Tc=6.0 min CN=98 Runoff=3.0 cfs 10,385 cf

Subcatchment3.1S: Backyard ADs Runoff Area=8,985 sf 3.03% Impervious Runoff Depth=1.68"
Flow Length=147' Tc=10.3 min CN=75 Runoff=0.3 cfs 1,259 cf

Subcatchment3S: Townhouse Roofs Runoff Area=13,067 sf 100.00% Impervious Runoff Depth=3.79"
Tc=6.0 min CN=98 Runoff=1.2 cfs 4,122 cf

Subcatchment4.2S: TD-2 Runoff Area=1,112 sf 95.68% Impervious Runoff Depth=3.67"
Tc=6.0 min CN=97 Runoff=0.1 cfs 340 cf

Subcatchment4.3S: TD-3 Runoff Area=1,105 sf 97.29% Impervious Runoff Depth=3.67"
Tc=6.0 min CN=97 Runoff=0.1 cfs 338 cf

Subcatchment4.4S: TD-4 Runoff Area=1,104 sf 97.46% Impervious Runoff Depth=3.67"
Tc=6.0 min CN=97 Runoff=0.1 cfs 338 cf

Subcatchment4.5S: TD-5 Runoff Area=1,082 sf 98.06% Impervious Runoff Depth=3.79"
Tc=6.0 min CN=98 Runoff=0.1 cfs 341 cf

Subcatchment4.6S: TD-6 Runoff Area=1,056 sf 99.24% Impervious Runoff Depth=3.79"
Tc=6.0 min CN=98 Runoff=0.1 cfs 333 cf

Subcatchment5.1S: TD-1A Runoff Area=1,389 sf 84.59% Impervious Runoff Depth=3.34"
Tc=6.0 min CN=94 Runoff=0.1 cfs 387 cf

Subcatchment5S: TD-1B Runoff Area=4,462 sf 42.78% Impervious Runoff Depth=2.39"
Tc=6.0 min CN=84 Runoff=0.3 cfs 888 cf

Subcatchment6.1S: East driveway Runoff Area=12,275 sf 52.50% Impervious Runoff Depth=2.66"
Tc=6.0 min CN=87 Runoff=0.9 cfs 2,716 cf

Subcatchment6S: Bypass Towards Runoff Area=51,539 sf 0.21% Impervious Runoff Depth=1.61"
Flow Length=125' Tc=14.0 min CN=74 Runoff=1.7 cfs 6,919 cf

Subcatchment7S: To Street Runoff Area=5,843 sf 18.07% Impervious Runoff Depth=1.90"
Tc=6.0 min CN=78 Runoff=0.3 cfs 927 cf

Pond 1P: Inf Syst-1 Peak Elev=9.37' Storage=8,769 cf Inflow=4.8 cfs 16,622 cf
Discarded=0.1 cfs 13,377 cf Primary=0.3 cfs 3,246 cf Outflow=0.4 cfs 16,622 cf

Pond 3P: Rain garden Peak Elev=6.42' Storage=216 cf Inflow=0.9 cfs 2,716 cf
Discarded=0.0 cfs 444 cf Primary=0.9 cfs 2,272 cf Outflow=0.9 cfs 2,716 cf

Pond 4P: Inf Syst-2 Peak Elev=9.41' Storage=129 cf Inflow=0.1 cfs 340 cf
Discarded=0.0 cfs 156 cf Primary=0.1 cfs 171 cf Outflow=0.1 cfs 327 cf

Pond 5P: Inf Syst-3 Peak Elev=9.55' Storage=134 cf Inflow=0.1 cfs 338 cf
Discarded=0.0 cfs 156 cf Primary=0.1 cfs 163 cf Outflow=0.1 cfs 319 cf

Pond 6P: Inf Syst-4 Peak Elev=9.55' Storage=134 cf Inflow=0.1 cfs 338 cf
Discarded=0.0 cfs 156 cf Primary=0.1 cfs 163 cf Outflow=0.1 cfs 319 cf

Pond 7P: Inf Syst-5 Peak Elev=9.18' Storage=117 cf Inflow=0.1 cfs 341 cf
Discarded=0.0 cfs 157 cf Primary=0.1 cfs 183 cf Outflow=0.1 cfs 341 cf

Pond 8P: Inf Syst-6 Peak Elev=9.20' Storage=118 cf Inflow=0.1 cfs 333 cf
Discarded=0.0 cfs 157 cf Primary=0.1 cfs 175 cf Outflow=0.1 cfs 332 cf

Pond 9P: Inf Syst-7 Peak Elev=7.84' Storage=1,431 cf Inflow=1.9 cfs 6,142 cf
Discarded=0.0 cfs 1,379 cf Primary=1.1 cfs 4,762 cf Outflow=1.1 cfs 6,142 cf

Link 1L: Towards Wetlands Inflow=3.6 cfs 18,088 cf
Primary=3.6 cfs 18,088 cf

Link 2L: Towards Street Inflow=0.3 cfs 927 cf
Primary=0.3 cfs 927 cf

Link 100L: Total Flows Inflow=3.8 cfs 19,014 cf
Primary=3.8 cfs 19,014 cf

Total Runoff Area = 158,686 sf Runoff Volume = 35,048 cf Average Runoff Depth = 2.65"
50.41% Pervious = 79,997 sf 49.59% Impervious = 78,689 sf

Summary for Subcatchment 1S: CB-1

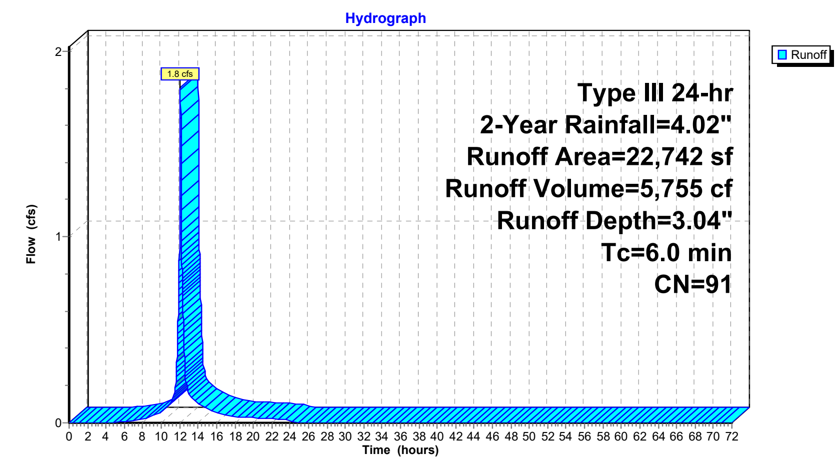
Runoff = 1.8 cfs @ 12.09 hrs, Volume= 5,755 cf, Depth= 3.04"
Routed to Pond 9P : Inf Syst-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
16,410	98	Paved parking, HSG C
6,332	74	>75% Grass cover, Good, HSG C
22,742	91	Weighted Average
6,332		27.84% Pervious Area
16,410		72.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 1S: CB-1



Summary for Subcatchment 2S: Building Roof

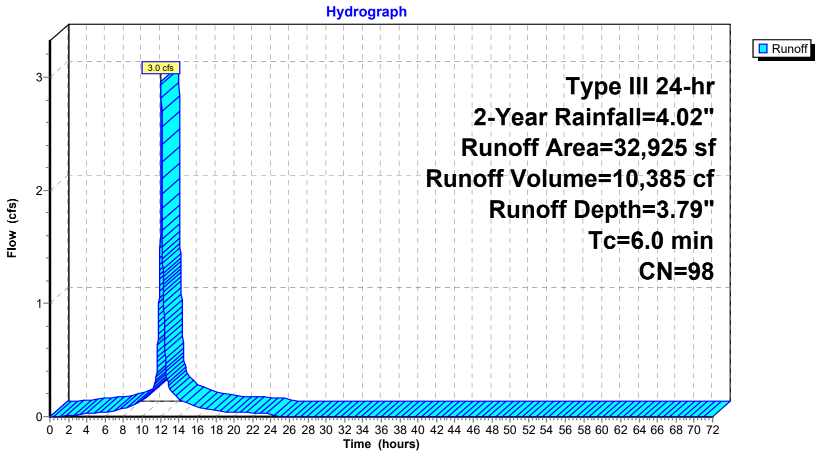
Runoff = 3.0 cfs @ 12.08 hrs, Volume= 10,385 cf, Depth= 3.79"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
32,925	98	Roofs, HSG C
32,925		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 2S: Building Roof



Summary for Subcatchment 3.1S: Backyard ADs

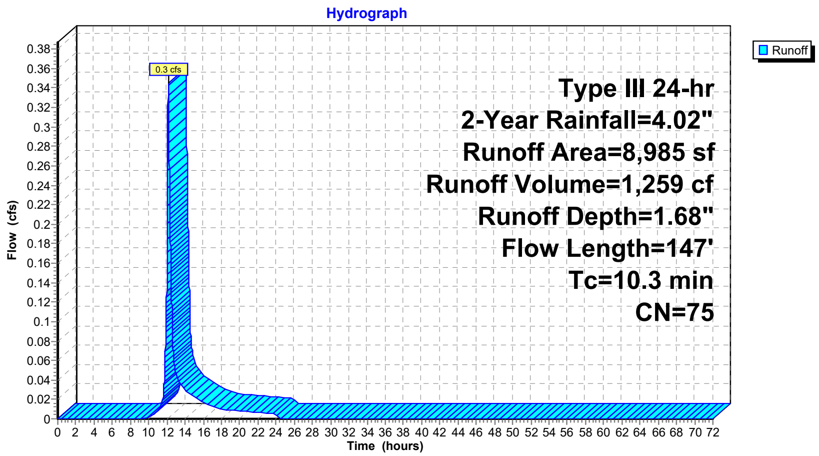
Runoff = 0.3 cfs @ 12.15 hrs, Volume= 1,259 cf, Depth= 1.68"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

	Area (sf)	CN	Description
	272	98	Unconnected pavement, HSG C
	8,302	74	>75% Grass cover, Good, HSG C
*	411	89	Gravel sidewalk, HSG C
	8,985	75	Weighted Average
	8,713		96.97% Pervious Area
	272		3.03% Impervious Area
	272		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	50	0.0142	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.23"
0.9	97	0.0154	1.86		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
10.3	147	Total			

Subcatchment 3.1S: Backyard ADs



Summary for Subcatchment 3S: Townhouse Roofs

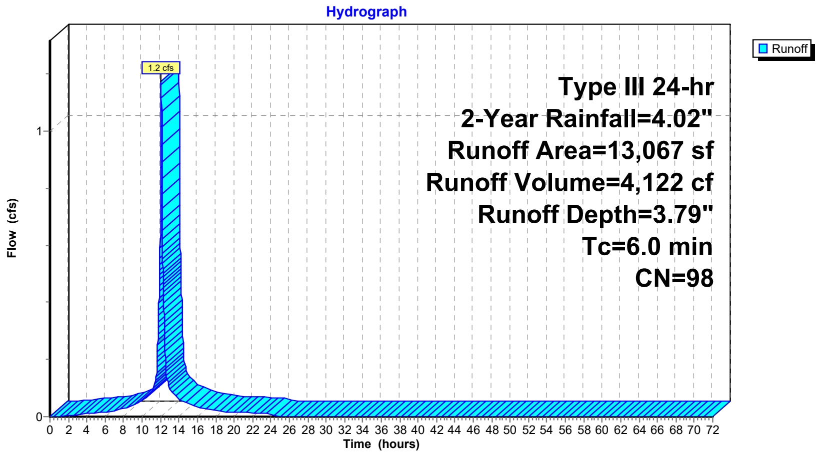
Runoff = 1.2 cfs @ 12.08 hrs, Volume= 4,122 cf, Depth= 3.79"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
13,067	98	Roofs, HSG C
13,067		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 3S: Townhouse Roofs



Summary for Subcatchment 4.2S: TD-2

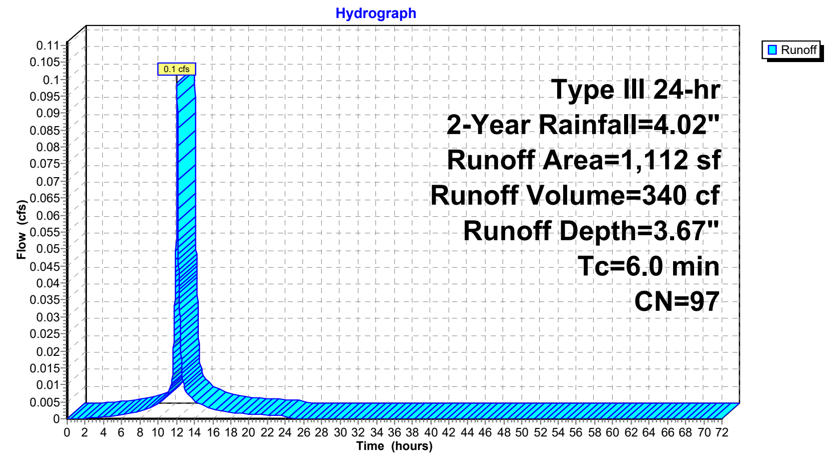
Runoff = 0.1 cfs @ 12.08 hrs, Volume= 340 cf, Depth= 3.67"
Routed to Pond 4P : Inf Syst-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
1,064	98	Paved parking, HSG C
48	74	>75% Grass cover, Good, HSG C
1,112	97	Weighted Average
48		4.32% Pervious Area
1,064		95.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.2S: TD-2



Summary for Subcatchment 4.3S: TD-3

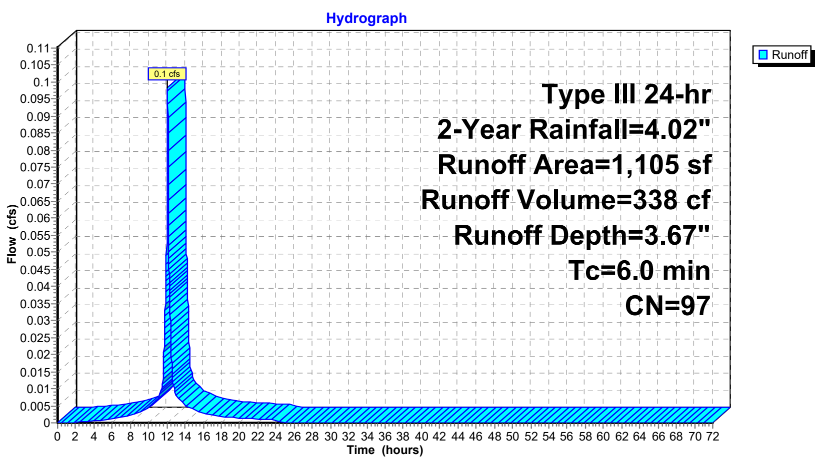
Runoff = 0.1 cfs @ 12.08 hrs, Volume= 338 cf, Depth= 3.67"
Routed to Pond 5P : Inf Syst-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
1,075	98	Paved parking, HSG C
30	74	>75% Grass cover, Good, HSG C
1,105	97	Weighted Average
30		2.71% Pervious Area
1,075		97.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.3S: TD-3



Summary for Subcatchment 4.4S: TD-4

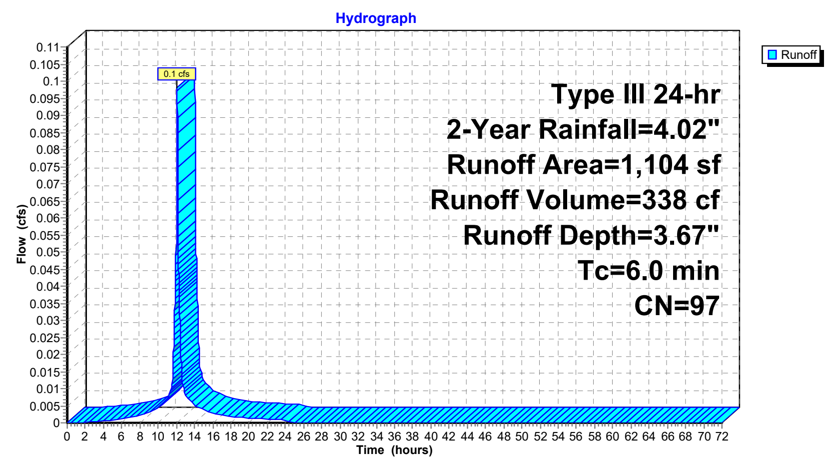
Runoff = 0.1 cfs @ 12.08 hrs, Volume= 338 cf, Depth= 3.67"
Routed to Pond 6P : Inf Syst-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
1,076	98	Paved parking, HSG C
28	74	>75% Grass cover, Good, HSG C
1,104	97	Weighted Average
28		2.54% Pervious Area
1,076		97.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.4S: TD-4



Summary for Subcatchment 4.5S: TD-5

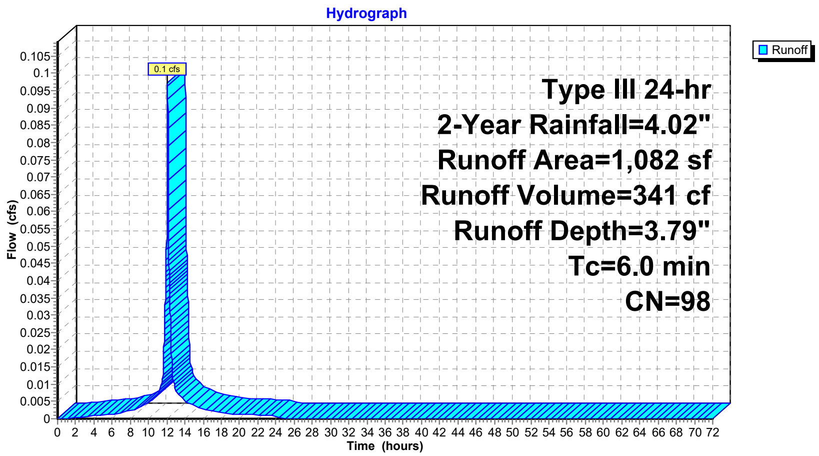
Runoff = 0.1 cfs @ 12.08 hrs, Volume= 341 cf, Depth= 3.79"
Routed to Pond 7P : Inf Syst-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
1,061	98	Paved parking, HSG C
21	74	>75% Grass cover, Good, HSG C
1,082	98	Weighted Average
21		1.94% Pervious Area
1,061		98.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.5S: TD-5



Summary for Subcatchment 4.6S: TD-6

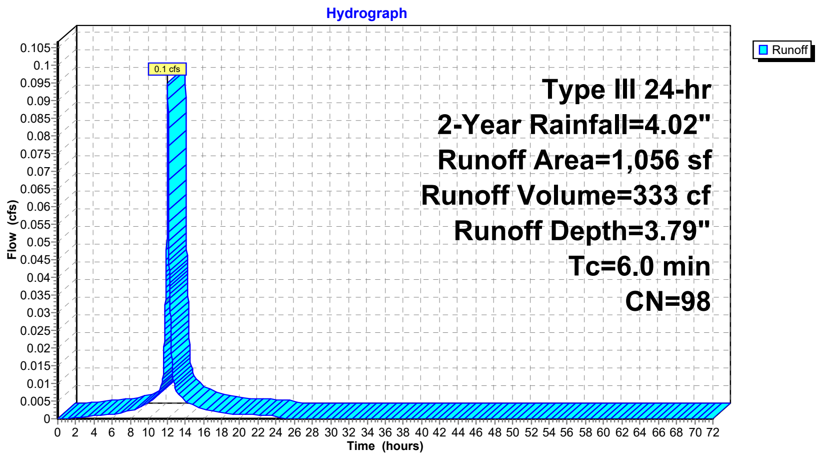
Runoff = 0.1 cfs @ 12.08 hrs, Volume= 333 cf, Depth= 3.79"
Routed to Pond 8P : Inf Syst-6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
1,048	98	Paved parking, HSG C
8	74	>75% Grass cover, Good, HSG C
1,056	98	Weighted Average
8		0.76% Pervious Area
1,048		99.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.6S: TD-6



Summary for Subcatchment 5.1S: TD-1A

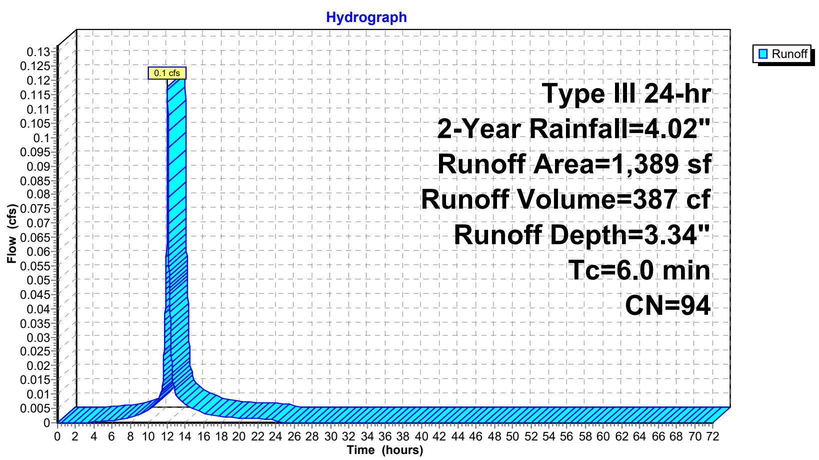
Runoff = 0.1 cfs @ 12.08 hrs, Volume= 387 cf, Depth= 3.34"
Routed to Pond 9P : Inf Syst-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
1,175	98	Paved parking, HSG C
214	74	>75% Grass cover, Good, HSG C
1,389	94	Weighted Average
214		15.41% Pervious Area
1,175		84.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 5.1S: TD-1A



Summary for Subcatchment 5S: TD-1B

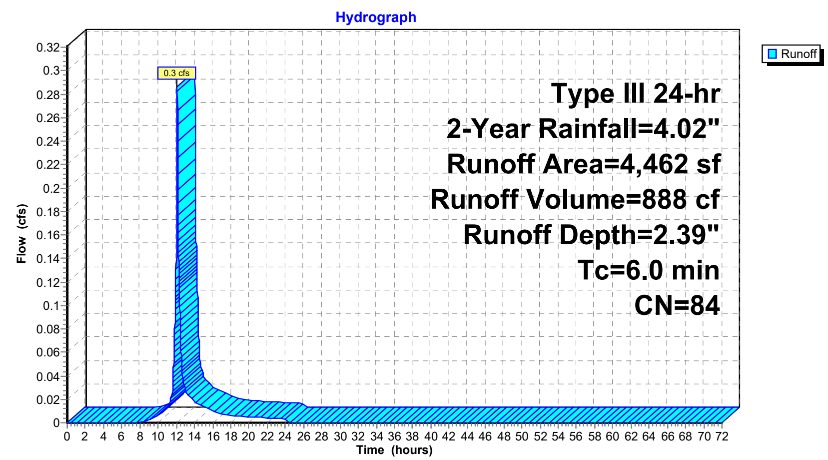
Runoff = 0.3 cfs @ 12.09 hrs, Volume= 888 cf, Depth= 2.39"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
1,909	98	Paved parking, HSG C
2,553	74	>75% Grass cover, Good, HSG C
4,462	84	Weighted Average
2,553		57.22% Pervious Area
1,909		42.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 5S: TD-1B



Summary for Subcatchment 6.1S: East driveway

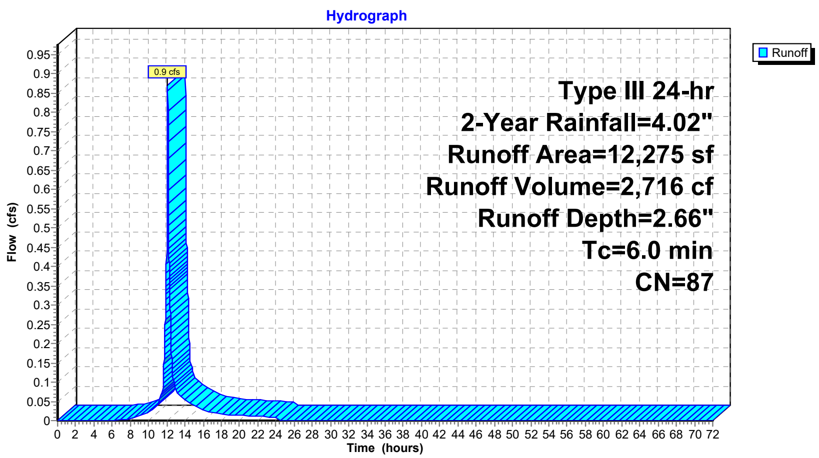
Runoff = 0.9 cfs @ 12.09 hrs, Volume= 2,716 cf, Depth= 2.66"
Routed to Pond 3P : Rain garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
5,611	74	>75% Grass cover, Good, HSG C
6,444	98	Paved roads w/curbs & sewers, HSG C
220	89	Gravel roads, HSG C
12,275	87	Weighted Average
5,831		47.50% Pervious Area
6,444		52.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 6.1S: East driveway



Summary for Subcatchment 6S: Bypass Towards Wetlands

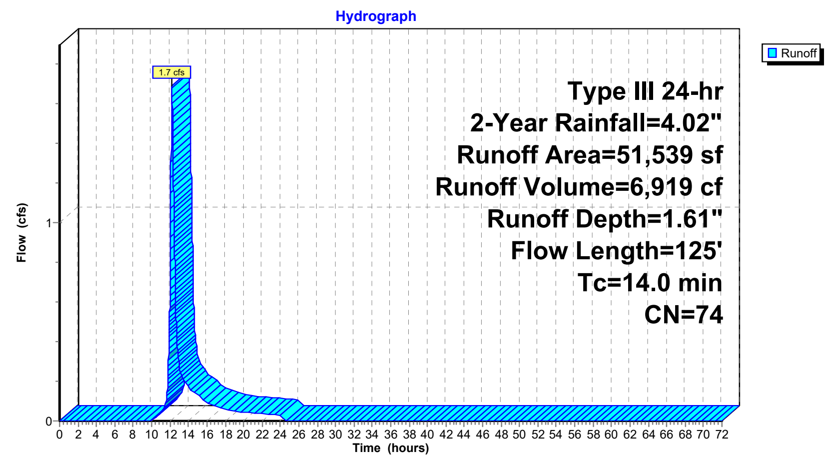
Runoff = 1.7 cfs @ 12.20 hrs, Volume= 6,919 cf, Depth= 1.61"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
4,985	70	Woods, Good, HSG C
46,447	74	>75% Grass cover, Good, HSG C
107	98	Roofs, HSG C
51,539	74	Weighted Average
51,432		99.79% Pervious Area
107		0.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	50	0.0220	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
2.2	75	0.0133	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	125	Total			

Subcatchment 6S: Bypass Towards Wetlands



Summary for Subcatchment 7S: To Street

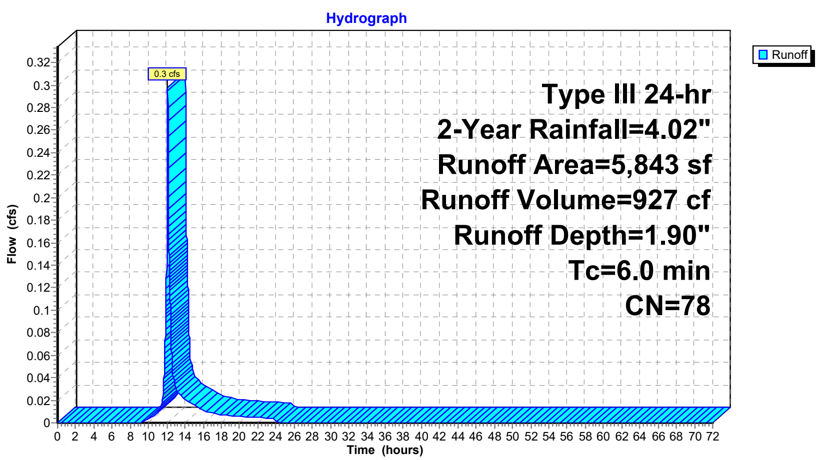
Runoff = 0.3 cfs @ 12.09 hrs, Volume= 927 cf, Depth= 1.90"
Routed to Link 2L : Towards Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
1,056	98	Paved parking, HSG C
4,787	74	>75% Grass cover, Good, HSG C
5,843	78	Weighted Average
4,787		81.93% Pervious Area
1,056		18.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 7S: To Street



Summary for Pond 1P: Inf Syst-1

Inflow Area = 60,436 sf, 85.36% Impervious, Inflow Depth = 3.30" for 2-Year event
Inflow = 4.8 cfs @ 12.09 hrs, Volume= 16,622 cf
Outflow = 0.4 cfs @ 13.02 hrs, Volume= 16,622 cf, Atten= 91%, Lag= 55.8 min
Discarded = 0.1 cfs @ 8.25 hrs, Volume= 13,377 cf
Primary = 0.3 cfs @ 13.02 hrs, Volume= 3,246 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.37' @ 13.02 hrs Surf.Area= 7,459 sf Storage= 8,769 cf

Plug-Flow detention time= 660.2 min calculated for 16,620 cf (100% of inflow)
Center-of-Mass det. time= 660.3 min (1,423.4 - 763.1)

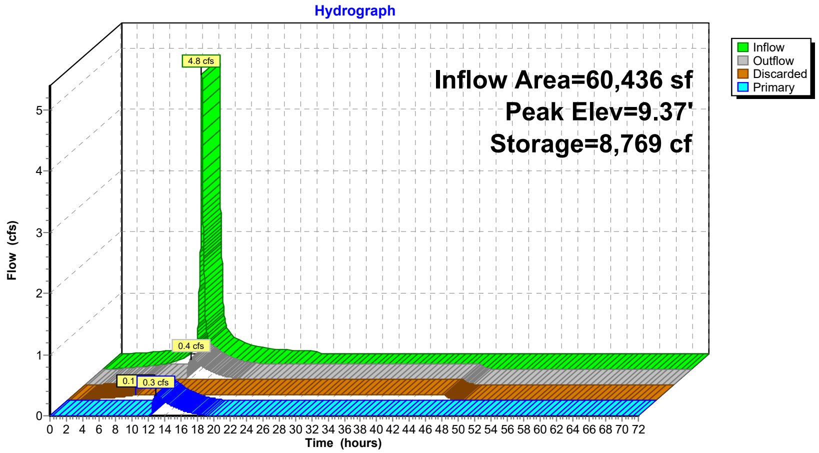
Volume	Invert	Avail.Storage	Storage Description
#1	8.00'	19,245 cf	**6.89'W x 14.06'L x 3.00'H StormTrap ST-1 Units (Irregular Shape)** x 77 22,378 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	8.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	8.00'	**15.0" Round Culvert** L= 26.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 8.00' / 7.13' S= 0.0335 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#3	Device 2	9.22'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	10.05'	**20.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 2	10.79'	**3.7' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.1 cfs @ 8.25 hrs HW=8.03' (Free Discharge)
└1=**Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.3 cfs @ 13.02 hrs HW=9.37' (Free Discharge)
└2=**Culvert** (Passes 0.3 cfs of 5.1 cfs potential flow)
 ├3=**Orifice/Grate** (Orifice Controls 0.3 cfs @ 1.23 fps)
 ├4=**Orifice/Grate** (Controls 0.0 cfs)
 └5=**Sharp-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 1P: Inf Syst-1



Summary for Pond 3P: Rain garden

Inflow Area = 12,275 sf, 52.50% Impervious, Inflow Depth = 2.66" for 2-Year event
Inflow = 0.9 cfs @ 12.09 hrs, Volume= 2,716 cf
Outflow = 0.9 cfs @ 12.09 hrs, Volume= 2,716 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.0 cfs @ 12.09 hrs, Volume= 444 cf
Primary = 0.9 cfs @ 12.09 hrs, Volume= 2,272 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 6.42' @ 12.09 hrs Surf.Area= 412 sf Storage= 216 cf

Plug-Flow detention time= 90.5 min calculated for 2,715 cf (100% of inflow)
Center-of-Mass det. time= 90.6 min (900.2 - 809.6)

Volume	Invert	Avail.Storage	Storage Description
#1	5.60'	253 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

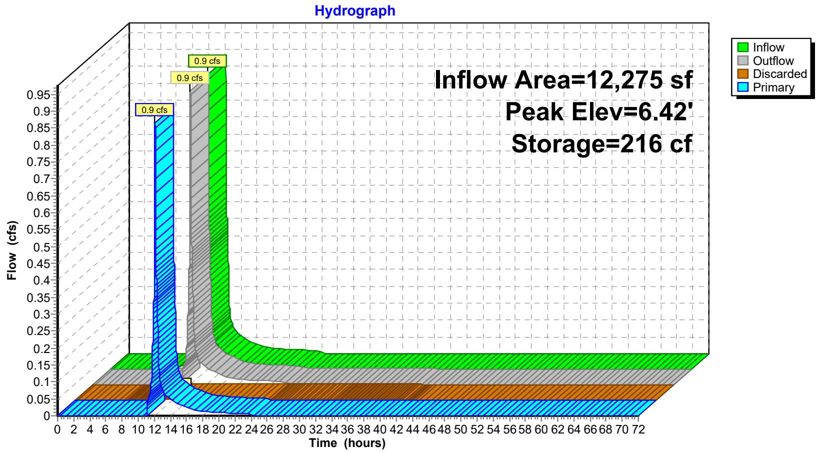
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.60	125	46.0	0	0	125
6.00	276	66.0	78	78	305
6.30	350	73.0	94	172	385
6.50	460	87.0	81	253	564

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.60'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	6.35'	**22.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.0 cfs @ 12.09 hrs HW=6.42' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.9 cfs @ 12.09 hrs HW=6.42' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 0.9 cfs @ 0.60 fps)

Pond 3P: Rain garden



Summary for Pond 4P: Inf Syst-2

Inflow Area = 1,112 sf, 95.68% Impervious, Inflow Depth = 3.67" for 2-Year event
Inflow = 0.1 cfs @ 12.08 hrs, Volume= 340 cf
Outflow = 0.1 cfs @ 12.11 hrs, Volume= 327 cf, Atten= 4%, Lag= 1.4 min
Discarded = 0.0 cfs @ 4.64 hrs, Volume= 156 cf
Primary = 0.1 cfs @ 12.11 hrs, Volume= 171 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.41' @ 12.11 hrs Surf.Area= 101 sf Storage= 129 cf

Plug-Flow detention time= 773.3 min calculated for 327 cf (96% of inflow)
Center-of-Mass det. time= 749.8 min (1,510.3 - 760.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

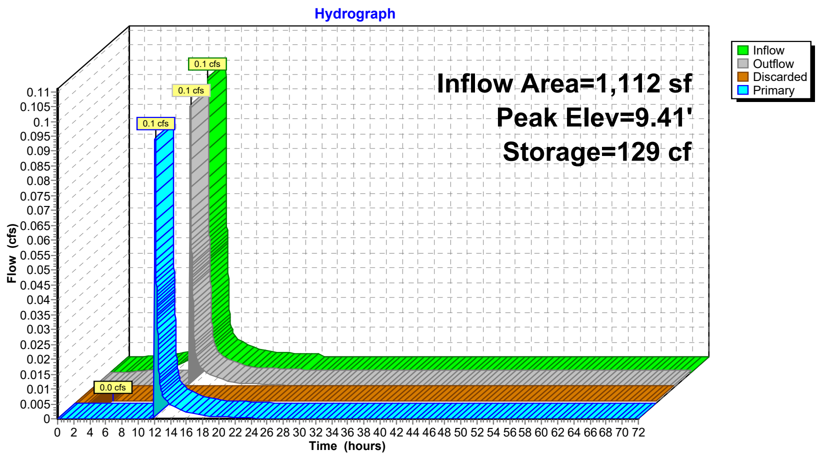
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.23'	**6.0" Round Culvert** L= 33.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.23' / 8.72' S= 0.0155 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 4.64 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.1 cfs @ 12.11 hrs HW=9.41' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.1 cfs @ 1.45 fps)

Pond 4P: Inf Syst-2



Summary for Pond 5P: Inf Syst-3

Inflow Area = 1,105 sf, 97.29% Impervious, Inflow Depth = 3.67" for 2-Year event
Inflow = 0.1 cfs @ 12.08 hrs, Volume= 338 cf
Outflow = 0.1 cfs @ 12.12 hrs, Volume= 319 cf, Atten= 8%, Lag= 2.2 min
Discarded = 0.0 cfs @ 4.68 hrs, Volume= 156 cf
Primary = 0.1 cfs @ 12.12 hrs, Volume= 163 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.55' @ 12.12 hrs Surf.Area= 101 sf Storage= 134 cf

Plug-Flow detention time= 799.9 min calculated for 319 cf (94% of inflow)
Center-of-Mass det. time= 768.5 min (1,529.0 - 760.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

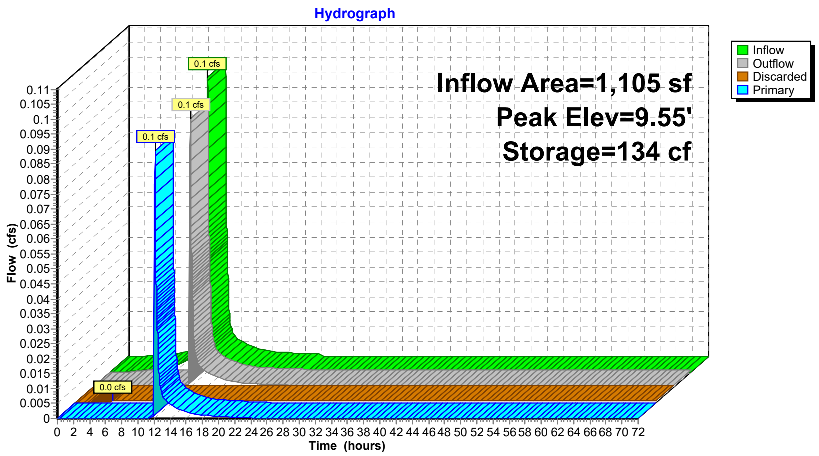
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.37'	**6.0" Round Culvert** L= 33.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.37' / 8.73' S= 0.0194 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 4.68 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.1 cfs @ 12.12 hrs HW=9.55' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.1 cfs @ 1.43 fps)

Pond 5P: Inf Syst-3



Summary for Pond 6P: Inf Syst-4

Inflow Area = 1,104 sf, 97.46% Impervious, Inflow Depth = 3.67" for 2-Year event
Inflow = 0.1 cfs @ 12.08 hrs, Volume= 338 cf
Outflow = 0.1 cfs @ 12.12 hrs, Volume= 319 cf, Atten= 9%, Lag= 2.2 min
Discarded = 0.0 cfs @ 4.68 hrs, Volume= 156 cf
Primary = 0.1 cfs @ 12.12 hrs, Volume= 163 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.55' @ 12.12 hrs Surf.Area= 101 sf Storage= 134 cf

Plug-Flow detention time= 800.6 min calculated for 319 cf (94% of inflow)
Center-of-Mass det. time= 769.2 min (1,529.7 - 760.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

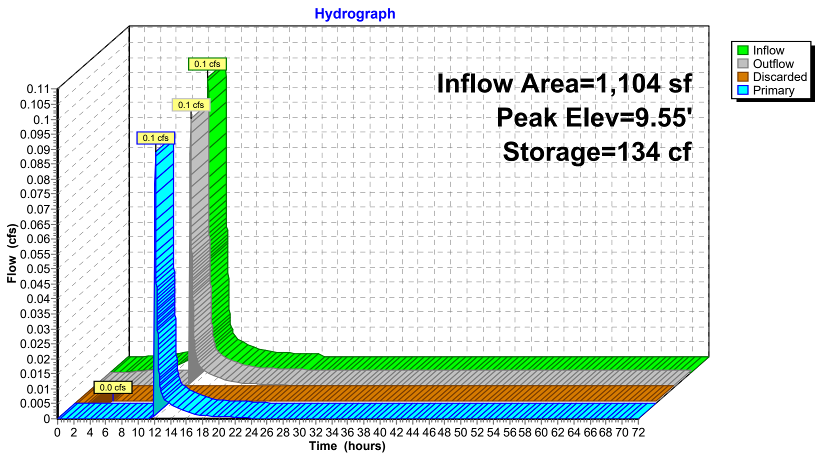
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.37'	**6.0" Round Culvert** L= 51.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.37' / 8.10' S= 0.0249 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 4.68 hrs HW=7.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.1 cfs @ 12.12 hrs HW=9.55' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.1 cfs @ 1.43 fps)

Pond 6P: Inf Syst-4



Summary for Pond 7P: Inf Syst-5

Inflow Area = 1,082 sf, 98.06% Impervious, Inflow Depth = 3.79" for 2-Year event
Inflow = 0.1 cfs @ 12.08 hrs, Volume= 341 cf
Outflow = 0.1 cfs @ 12.10 hrs, Volume= 341 cf, Atten= 1%, Lag= 0.7 min
Discarded = 0.0 cfs @ 3.77 hrs, Volume= 157 cf
Primary = 0.1 cfs @ 12.10 hrs, Volume= 183 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.18' @ 12.10 hrs Surf.Area= 101 sf Storage= 117 cf

Plug-Flow detention time= 722.0 min calculated for 341 cf (100% of inflow)
Center-of-Mass det. time= 721.1 min (1,473.0 - 751.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A** 241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1 Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf 10 Chambers in 2 Rows
		125 cf	Total Available Storage

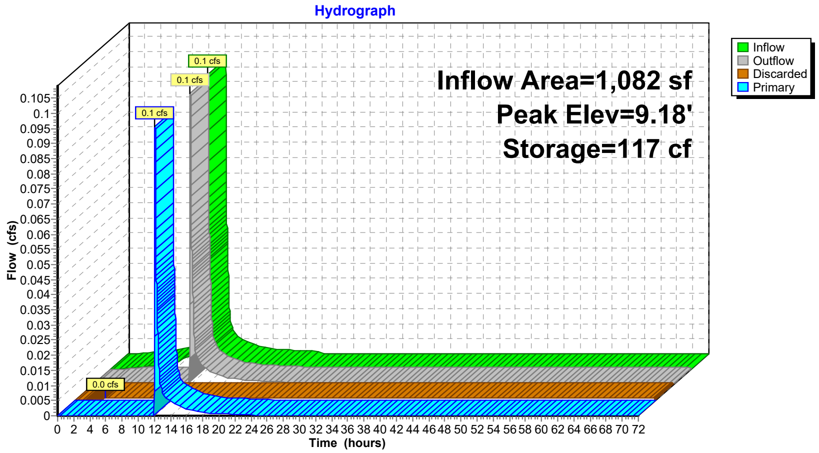
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**6.0" Round Culvert** L= 48.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.00' / 8.35' S= 0.0135 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 3.77 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.1 cfs @ 12.10 hrs HW=9.18' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.1 cfs @ 1.46 fps)

Pond 7P: Inf Syst-5



Summary for Pond 8P: Inf Syst-6

Inflow Area = 1,056 sf, 99.24% Impervious, Inflow Depth = 3.79" for 2-Year event
Inflow = 0.1 cfs @ 12.08 hrs, Volume= 333 cf
Outflow = 0.1 cfs @ 12.10 hrs, Volume= 332 cf, Atten= 1%, Lag= 0.8 min
Discarded = 0.0 cfs @ 3.86 hrs, Volume= 157 cf
Primary = 0.1 cfs @ 12.10 hrs, Volume= 175 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.20' @ 12.10 hrs Surf.Area= 101 sf Storage= 118 cf

Plug-Flow detention time= 739.6 min calculated for 332 cf (100% of inflow)
Center-of-Mass det. time= 738.4 min (1,490.2 - 751.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A** 241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1 Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf 10 Chambers in 2 Rows
		125 cf	Total Available Storage

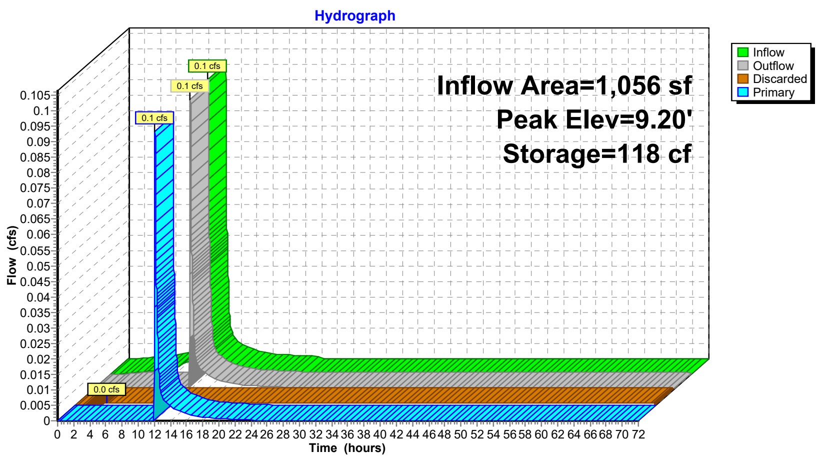
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**8.0" Round Culvert** L= 46.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.00' / 8.77' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 3.86 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.1 cfs @ 12.10 hrs HW=9.20' (Free Discharge)
└─**2=Culvert** (Barrel Controls 0.1 cfs @ 1.58 fps)

Pond 8P: Inf Syst-6



Summary for Pond 9P: Inf Syst-7

Inflow Area = 24,131 sf, 72.87% Impervious, Inflow Depth = 3.05" for 2-Year event
Inflow = 1.9 cfs @ 12.09 hrs, Volume= 6,142 cf
Outflow = 1.1 cfs @ 12.19 hrs, Volume= 6,142 cf, Atten= 41%, Lag= 6.4 min
Discarded = 0.0 cfs @ 7.94 hrs, Volume= 1,379 cf
Primary = 1.1 cfs @ 12.19 hrs, Volume= 4,762 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 7.84' @ 12.19 hrs Surf.Area= 2,422 sf Storage= 1,431 cf

Plug-Flow detention time= 91.3 min calculated for 6,141 cf (100% of inflow)
Center-of-Mass det. time= 91.4 min (884.7 - 793.3)

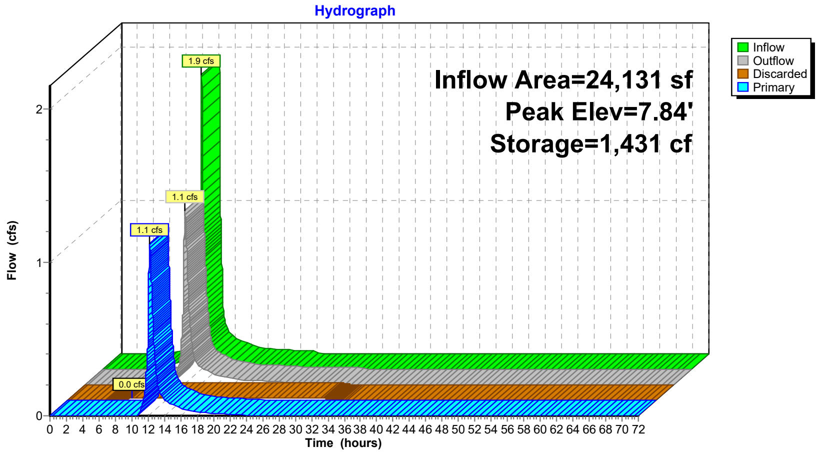
Volume	Invert	Avail.Storage	Storage Description
#1	7.15'	3,645 cf	**6.89'W x 14.06'L x 1.75'H StormTrap ST-1 Units (Irregular Shape)** x 25 4,238 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.15'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	7.15'	**12.0" Round Culvert** L= 4.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.15' / 7.13' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	7.35'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 7.94 hrs HW=7.17' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=1.1 cfs @ 12.19 hrs HW=7.84' (Free Discharge)
└─**2=Culvert** (Barrel Controls 1.1 cfs @ 2.76 fps)
  └─**3=Orifice/Grate** (Passes 1.1 cfs of 1.6 cfs potential flow)

Pond 9P: Inf Syst-7

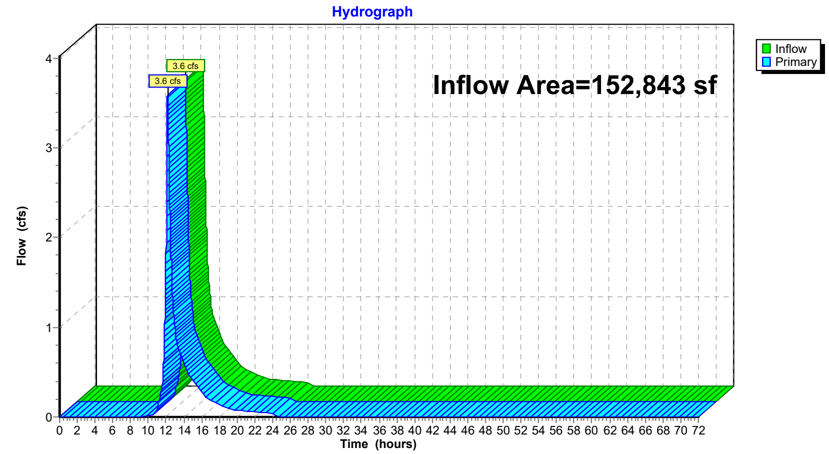


Summary for Link 1L: Towards Wetlands

Inflow Area = 152,843 sf, 50.79% Impervious, Inflow Depth = 1.42" for 2-Year event
Inflow = 3.6 cfs @ 12.16 hrs, Volume= 18,088 cf
Primary = 3.6 cfs @ 12.16 hrs, Volume= 18,088 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 1L: Towards Wetlands

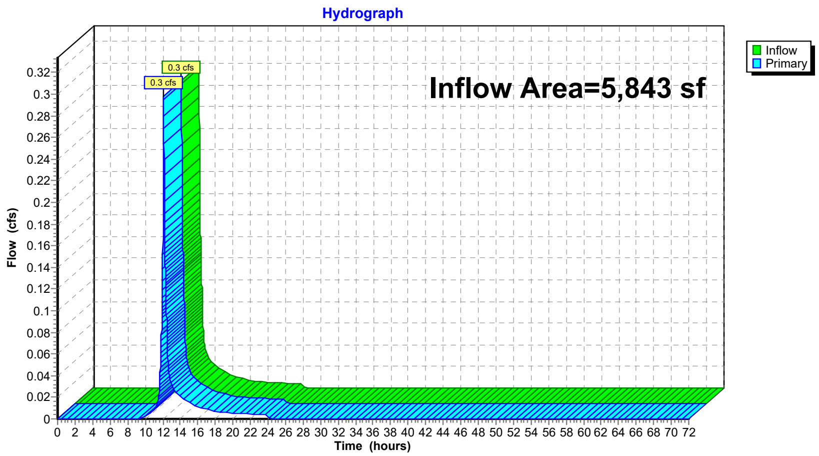


Summary for Link 2L: Towards Street

Inflow Area = 5,843 sf, 18.07% Impervious, Inflow Depth = 1.90" for 2-Year event
Inflow = 0.3 cfs @ 12.09 hrs, Volume= 927 cf
Primary = 0.3 cfs @ 12.09 hrs, Volume= 927 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 2L: Towards Street

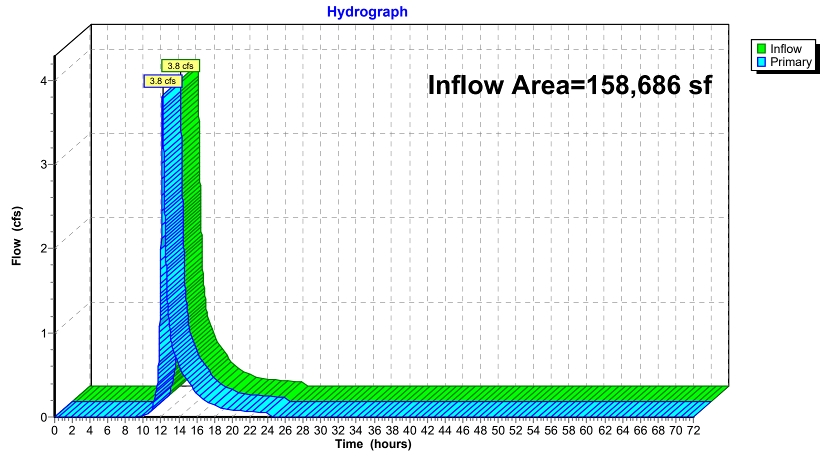


Summary for Link 100L: Total Flows

Inflow Area = 158,686 sf, 49.59% Impervious, Inflow Depth = 1.44" for 2-Year event
Inflow = 3.8 cfs @ 12.15 hrs, Volume= 19,014 cf
Primary = 3.8 cfs @ 12.15 hrs, Volume= 19,014 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 100L: Total Flows



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: CB-1 Runoff Area=22,742 sf 72.16% Impervious Runoff Depth=5.35"
Tc=6.0 min CN=91 Runoff=3.1 cfs 10,138 cf

Subcatchment2S: Building Roof Runoff Area=32,925 sf 100.00% Impervious Runoff Depth=6.16"
Tc=6.0 min CN=98 Runoff=4.7 cfs 16,905 cf

Subcatchment3.1S: Backyard ADs Runoff Area=8,985 sf 3.03% Impervious Runoff Depth=3.63"
Flow Length=147' Tc=10.3 min CN=75 Runoff=0.8 cfs 2,715 cf

Subcatchment3S: Townhouse Roofs Runoff Area=13,067 sf 100.00% Impervious Runoff Depth=6.16"
Tc=6.0 min CN=98 Runoff=1.9 cfs 6,709 cf

Subcatchment4.2S: TD-2 Runoff Area=1,112 sf 95.68% Impervious Runoff Depth=6.04"
Tc=6.0 min CN=97 Runoff=0.2 cfs 560 cf

Subcatchment4.3S: TD-3 Runoff Area=1,105 sf 97.29% Impervious Runoff Depth=6.04"
Tc=6.0 min CN=97 Runoff=0.2 cfs 556 cf

Subcatchment4.4S: TD-4 Runoff Area=1,104 sf 97.46% Impervious Runoff Depth=6.04"
Tc=6.0 min CN=97 Runoff=0.2 cfs 556 cf

Subcatchment4.5S: TD-5 Runoff Area=1,082 sf 98.06% Impervious Runoff Depth=6.16"
Tc=6.0 min CN=98 Runoff=0.2 cfs 556 cf

Subcatchment4.6S: TD-6 Runoff Area=1,056 sf 99.24% Impervious Runoff Depth=6.16"
Tc=6.0 min CN=98 Runoff=0.2 cfs 542 cf

Subcatchment5.1S: TD-1A Runoff Area=1,389 sf 84.59% Impervious Runoff Depth=5.69"
Tc=6.0 min CN=94 Runoff=0.2 cfs 659 cf

Subcatchment5S: TD-1B Runoff Area=4,462 sf 42.78% Impervious Runoff Depth=4.57"
Tc=6.0 min CN=84 Runoff=0.5 cfs 1,700 cf

Subcatchment6.1S: East driveway Runoff Area=12,275 sf 52.50% Impervious Runoff Depth=4.90"
Tc=6.0 min CN=87 Runoff=1.6 cfs 5,013 cf

Subcatchment6S: Bypass Towards Runoff Area=51,539 sf 0.21% Impervious Runoff Depth=3.52"
Flow Length=125' Tc=14.0 min CN=74 Runoff=3.8 cfs 15,135 cf

Subcatchment7S: To Street Runoff Area=5,843 sf 18.07% Impervious Runoff Depth=3.93"
Tc=6.0 min CN=78 Runoff=0.6 cfs 1,916 cf

Pond 1P: Inf Syst-1 Peak Elev=9.96' Storage=12,545 cf Inflow=8.0 cfs 28,251 cf
Discarded=0.1 cfs 14,540 cf Primary=2.2 cfs 13,710 cf Outflow=2.3 cfs 28,251 cf

Pond 3P: Rain garden Peak Elev=6.45' Storage=229 cf Inflow=1.6 cfs 5,013 cf
Discarded=0.0 cfs 477 cf Primary=1.6 cfs 4,537 cf Outflow=1.6 cfs 5,013 cf

Pond 4P: Inf Syst-2 Peak Elev=9.47' Storage=131 cf Inflow=0.2 cfs 560 cf
Discarded=0.0 cfs 159 cf Primary=0.2 cfs 388 cf Outflow=0.2 cfs 547 cf

Pond 5P: Inf Syst-3 Peak Elev=9.61' Storage=137 cf Inflow=0.2 cfs 556 cf
Discarded=0.0 cfs 159 cf Primary=0.2 cfs 379 cf Outflow=0.2 cfs 537 cf

Pond 6P: Inf Syst-4 Peak Elev=9.61' Storage=137 cf Inflow=0.2 cfs 556 cf
Discarded=0.0 cfs 159 cf Primary=0.2 cfs 378 cf Outflow=0.2 cfs 537 cf

Pond 7P: Inf Syst-5 Peak Elev=9.24' Storage=119 cf Inflow=0.2 cfs 556 cf
Discarded=0.0 cfs 160 cf Primary=0.2 cfs 395 cf Outflow=0.2 cfs 555 cf

Pond 8P: Inf Syst-6 Peak Elev=9.26' Storage=120 cf Inflow=0.2 cfs 542 cf
Discarded=0.0 cfs 160 cf Primary=0.2 cfs 382 cf Outflow=0.2 cfs 541 cf

Pond 9P: Inf Syst-7 Peak Elev=8.14' Storage=2,069 cf Inflow=3.3 cfs 10,797 cf
Discarded=0.0 cfs 1,502 cf Primary=2.1 cfs 9,295 cf Outflow=2.1 cfs 10,797 cf

Link 1L: Towards Wetlands Inflow=9.0 cfs 44,377 cf
Primary=9.0 cfs 44,377 cf

Link 2L: Towards Street Inflow=0.6 cfs 1,916 cf
Primary=0.6 cfs 1,916 cf

Link 100L: Total Flows Inflow=9.4 cfs 46,293 cf
Primary=9.4 cfs 46,293 cf

Total Runoff Area = 158,686 sf Runoff Volume = 63,661 cf Average Runoff Depth = 4.81"
50.41% Pervious = 79,997 sf 49.59% Impervious = 78,689 sf

Summary for Subcatchment 1S: CB-1

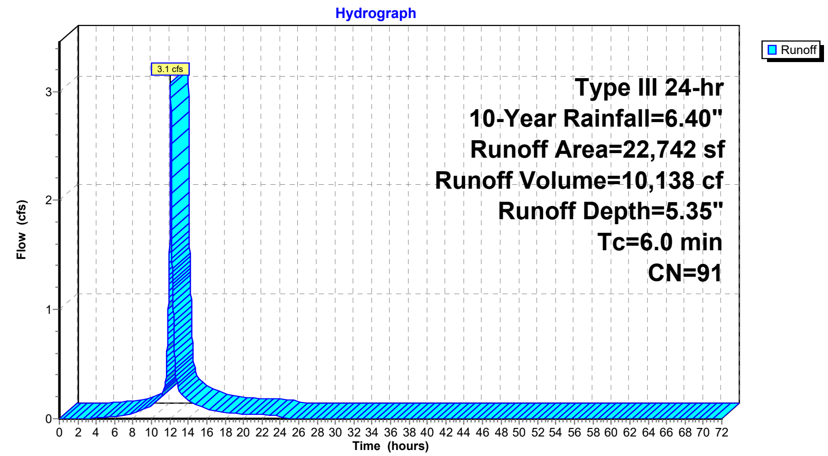
Runoff = 3.1 cfs @ 12.08 hrs, Volume= 10,138 cf, Depth= 5.35"
Routed to Pond 9P : Inf Syst-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
16,410	98	Paved parking, HSG C
6,332	74	>75% Grass cover, Good, HSG C
22,742	91	Weighted Average
6,332		27.84% Pervious Area
16,410		72.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 1S: CB-1



Summary for Subcatchment 2S: Building Roof

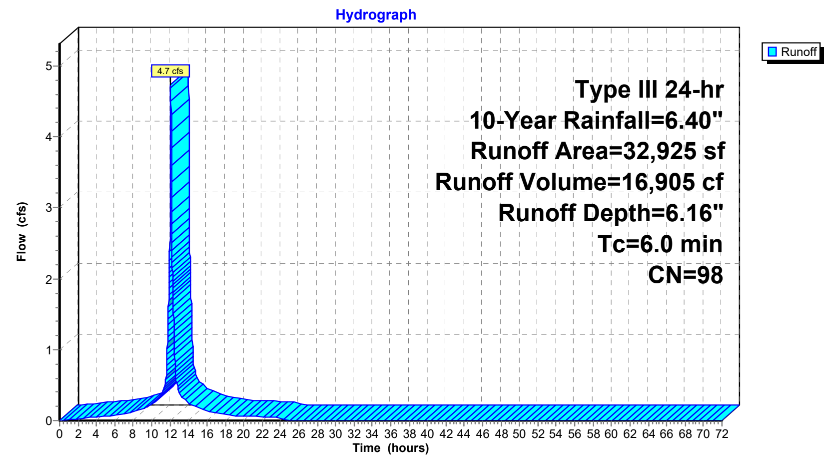
Runoff = 4.7 cfs @ 12.08 hrs, Volume= 16,905 cf, Depth= 6.16"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
32,925	98	Roofs, HSG C
32,925		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 2S: Building Roof



Summary for Subcatchment 3.1S: Backyard ADs

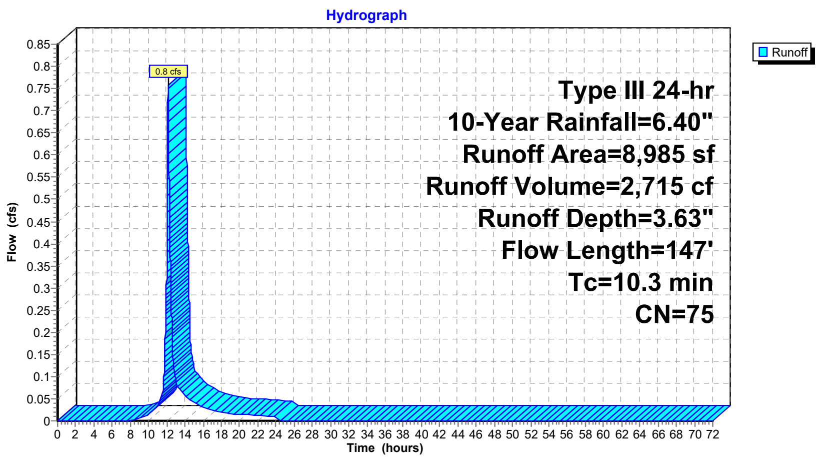
Runoff = 0.8 cfs @ 12.14 hrs, Volume= 2,715 cf, Depth= 3.63"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

	Area (sf)	CN	Description
	272	98	Unconnected pavement, HSG C
	8,302	74	>75% Grass cover, Good, HSG C
*	411	89	Gravel sidewalk, HSG C
	8,985	75	Weighted Average
	8,713		96.97% Pervious Area
	272		3.03% Impervious Area
	272		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	50	0.0142	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.23"
0.9	97	0.0154	1.86		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
10.3	147	Total			

Subcatchment 3.1S: Backyard ADs



Summary for Subcatchment 3S: Townhouse Roofs

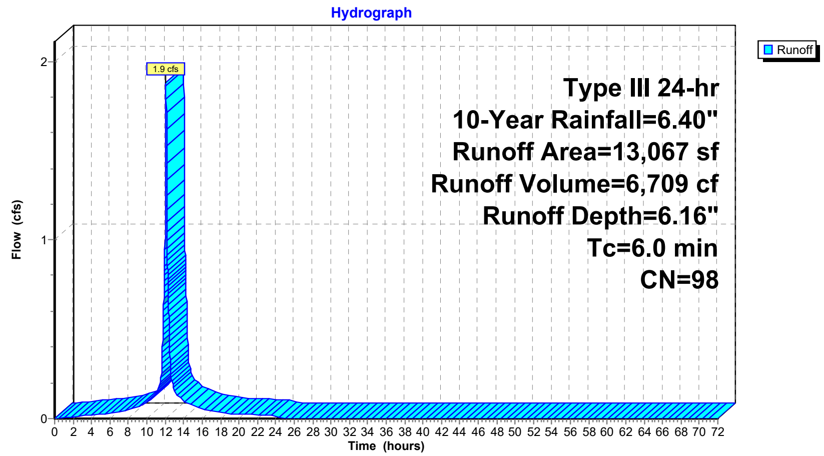
Runoff = 1.9 cfs @ 12.08 hrs, Volume= 6,709 cf, Depth= 6.16"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
13,067	98	Roofs, HSG C
13,067		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 3S: Townhouse Roofs



Summary for Subcatchment 4.2S: TD-2

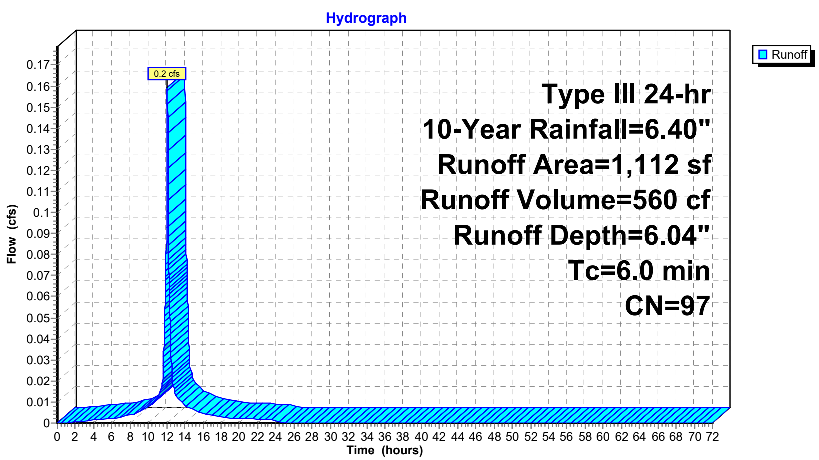
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 560 cf, Depth= 6.04"
Routed to Pond 4P : Inf Syst-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
1,064	98	Paved parking, HSG C
48	74	>75% Grass cover, Good, HSG C
1,112	97	Weighted Average
48		4.32% Pervious Area
1,064		95.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.2S: TD-2



Summary for Subcatchment 4.3S: TD-3

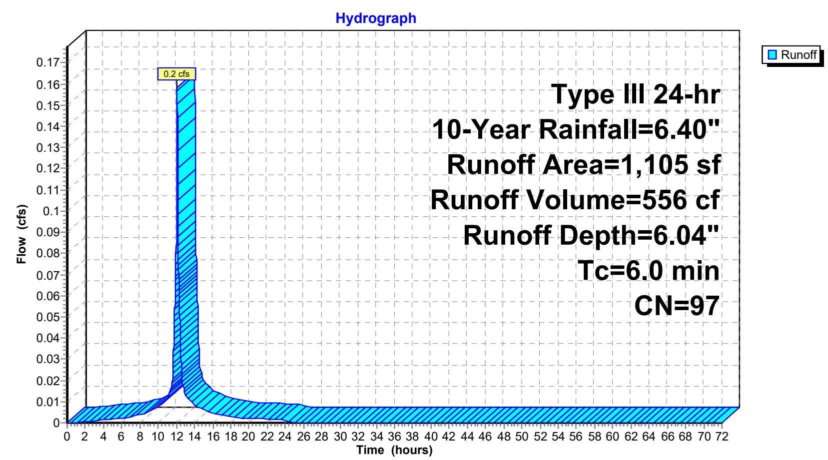
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 556 cf, Depth= 6.04"
Routed to Pond 5P : Inf Syst-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
1,075	98	Paved parking, HSG C
30	74	>75% Grass cover, Good, HSG C
1,105	97	Weighted Average
30		2.71% Pervious Area
1,075		97.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.3S: TD-3



Summary for Subcatchment 4.4S: TD-4

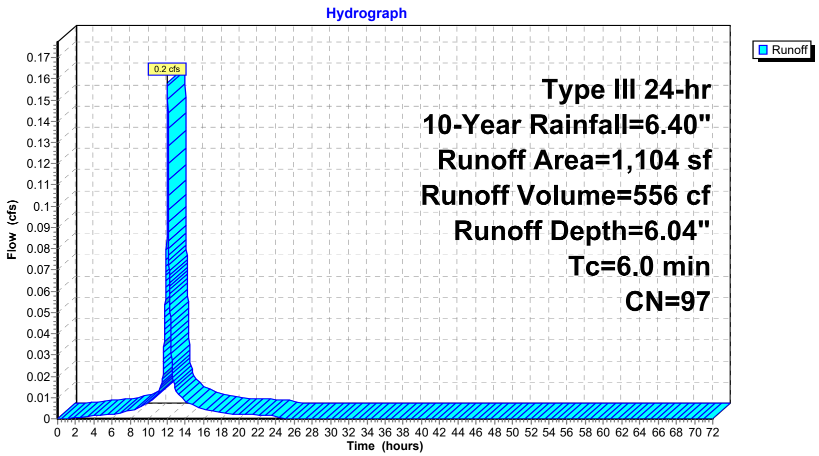
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 556 cf, Depth= 6.04"
Routed to Pond 6P : Inf Syst-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
1,076	98	Paved parking, HSG C
28	74	>75% Grass cover, Good, HSG C
1,104	97	Weighted Average
28		2.54% Pervious Area
1,076		97.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.4S: TD-4



Summary for Subcatchment 4.5S: TD-5

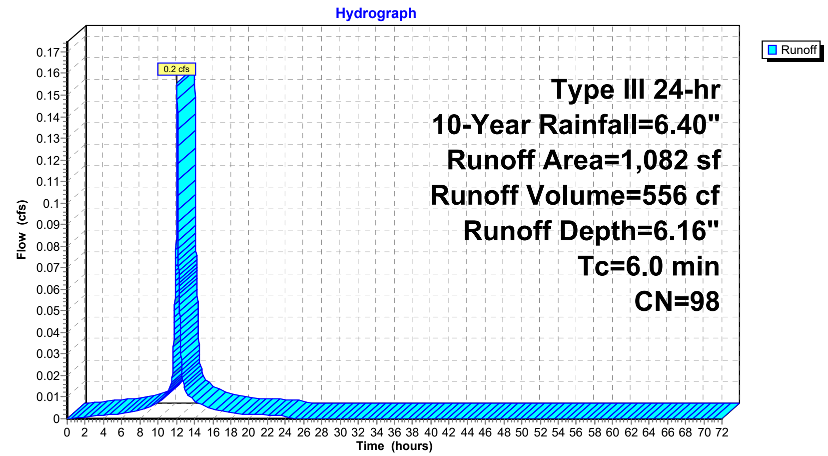
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 556 cf, Depth= 6.16"
Routed to Pond 7P : Inf Syst-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
1,061	98	Paved parking, HSG C
21	74	>75% Grass cover, Good, HSG C
1,082	98	Weighted Average
21		1.94% Pervious Area
1,061		98.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.5S: TD-5



Summary for Subcatchment 4.6S: TD-6

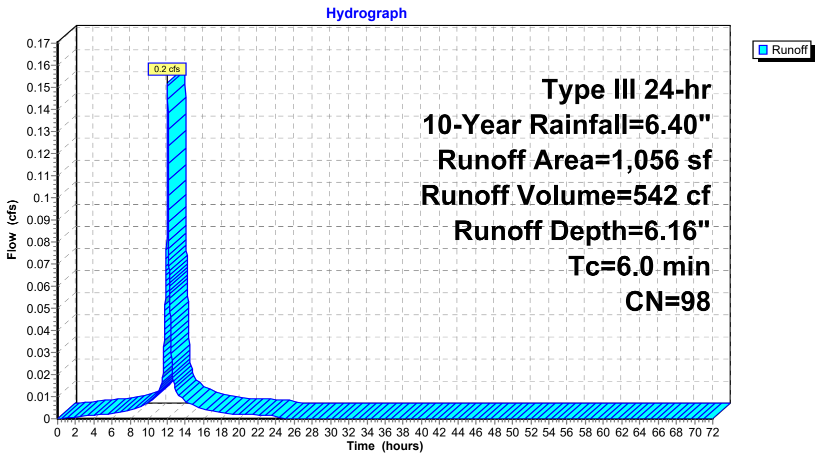
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 542 cf, Depth= 6.16"
Routed to Pond 8P : Inf Syst-6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
1,048	98	Paved parking, HSG C
8	74	>75% Grass cover, Good, HSG C
1,056	98	Weighted Average
8		0.76% Pervious Area
1,048		99.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.6S: TD-6



Summary for Subcatchment 5.1S: TD-1A

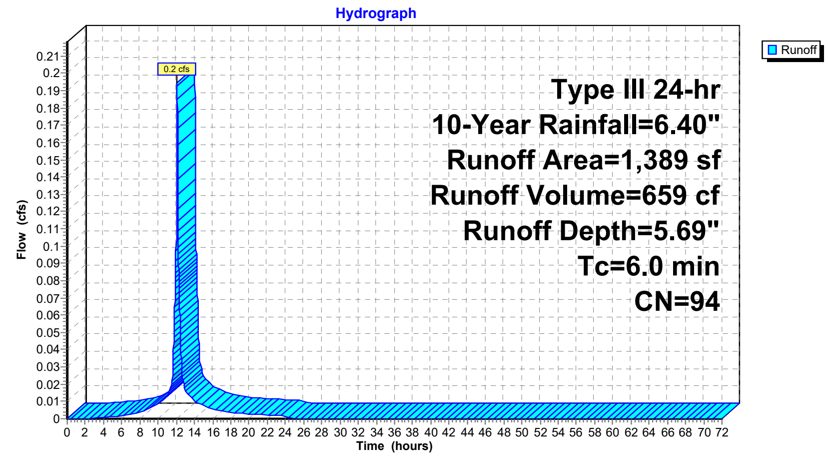
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 659 cf, Depth= 5.69"
Routed to Pond 9P : Inf Syst-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
1,175	98	Paved parking, HSG C
214	74	>75% Grass cover, Good, HSG C
1,389	94	Weighted Average
214		15.41% Pervious Area
1,175		84.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 5.1S: TD-1A



Summary for Subcatchment 5S: TD-1B

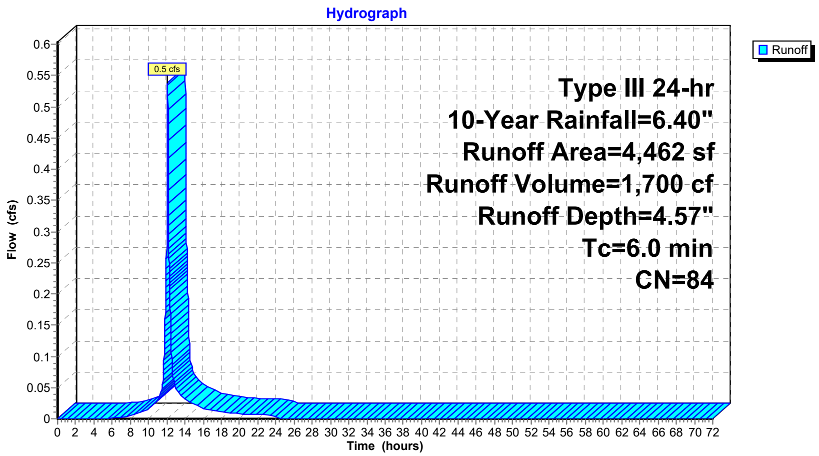
Runoff = 0.5 cfs @ 12.09 hrs, Volume= 1,700 cf, Depth= 4.57"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
1,909	98	Paved parking, HSG C
2,553	74	>75% Grass cover, Good, HSG C
4,462	84	Weighted Average
2,553		57.22% Pervious Area
1,909		42.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 5S: TD-1B



Summary for Subcatchment 6.1S: East driveway

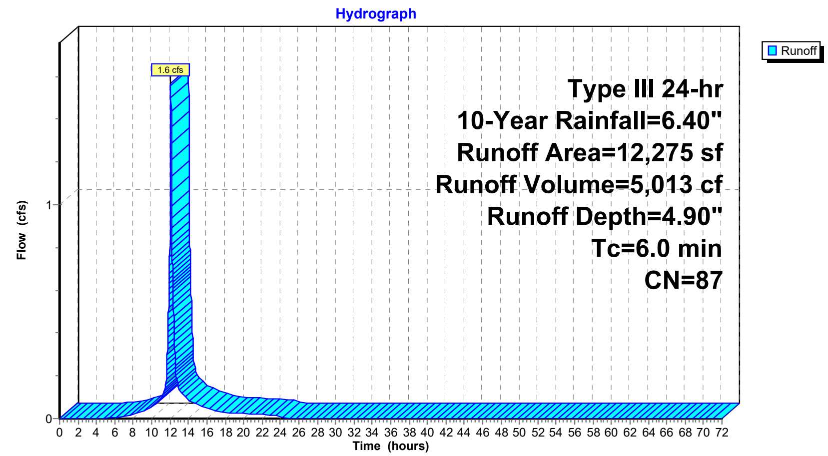
Runoff = 1.6 cfs @ 12.09 hrs, Volume= 5,013 cf, Depth= 4.90"
Routed to Pond 3P : Rain garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
5,611	74	>75% Grass cover, Good, HSG C
6,444	98	Paved roads w/curbs & sewers, HSG C
220	89	Gravel roads, HSG C
12,275	87	Weighted Average
5,831		47.50% Pervious Area
6,444		52.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 6.1S: East driveway



Summary for Subcatchment 6S: Bypass Towards Wetlands

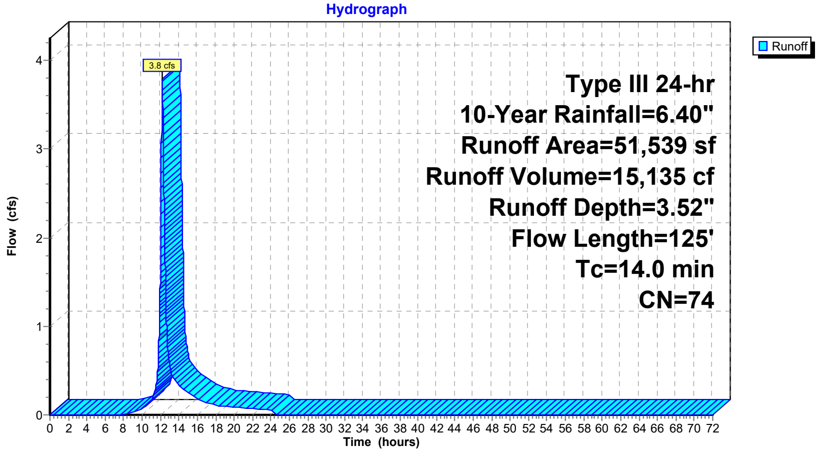
Runoff = 3.8 cfs @ 12.19 hrs, Volume= 15,135 cf, Depth= 3.52"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
4,985	70	Woods, Good, HSG C
46,447	74	>75% Grass cover, Good, HSG C
107	98	Roofs, HSG C
51,539	74	Weighted Average
51,432		99.79% Pervious Area
107		0.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	50	0.0220	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
2.2	75	0.0133	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	125	Total			

Subcatchment 6S: Bypass Towards Wetlands



Summary for Subcatchment 7S: To Street

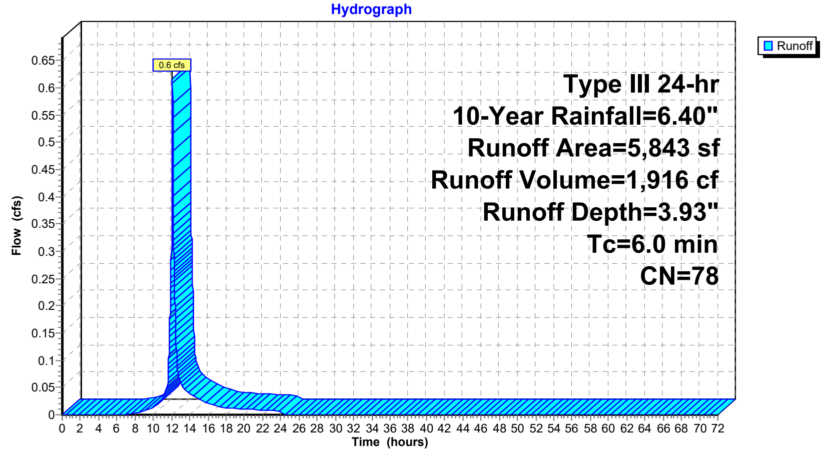
Runoff = 0.6 cfs @ 12.09 hrs, Volume= 1,916 cf, Depth= 3.93"
Routed to Link 2L : Towards Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
1,056	98	Paved parking, HSG C
4,787	74	>75% Grass cover, Good, HSG C
5,843	78	Weighted Average
4,787		81.93% Pervious Area
1,056		18.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 7S: To Street



Summary for Pond 1P: Inf Syst-1

Inflow Area = 60,436 sf, 85.36% Impervious, Inflow Depth = 5.61" for 10-Year event
Inflow = 8.0 cfs @ 12.09 hrs, Volume= 28,251 cf
Outflow = 2.3 cfs @ 12.43 hrs, Volume= 28,251 cf, Atten= 71%, Lag= 20.8 min
Discarded = 0.1 cfs @ 6.13 hrs, Volume= 14,540 cf
Primary = 2.2 cfs @ 12.43 hrs, Volume= 13,710 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.96' @ 12.43 hrs Surf.Area= 7,459 sf Storage= 12,545 cf

Plug-Flow detention time= 442.3 min calculated for 28,251 cf (100% of inflow)
Center-of-Mass det. time= 442.2 min (1,198.8 - 756.6)

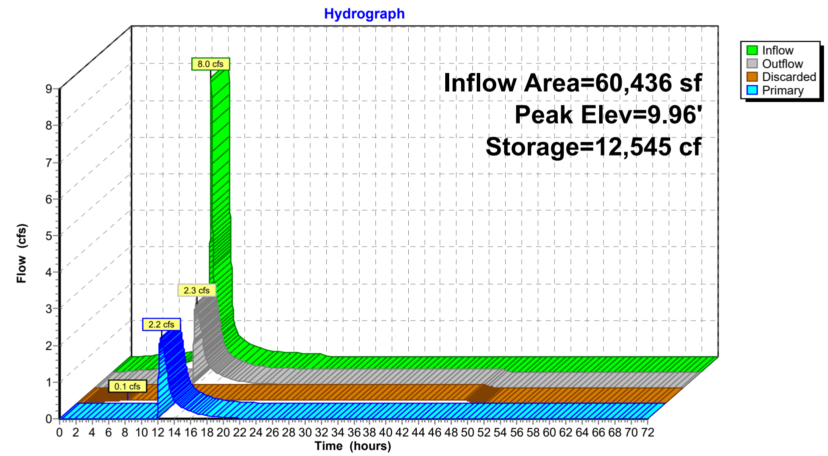
Volume	Invert	Avail.Storage	Storage Description
#1	8.00'	19,245 cf	**6.89'W x 14.06'L x 3.00'H StormTrap ST-1 Units (Irregular Shape)** x 77 22,378 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	8.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	8.00'	**15.0" Round Culvert** L= 26.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 8.00' / 7.13' S= 0.0335 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#3	Device 2	9.22'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	10.05'	**20.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 2	10.79'	**3.7' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.1 cfs @ 6.13 hrs HW=8.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=2.2 cfs @ 12.43 hrs HW=9.96' (Free Discharge)
└─**2=Culvert** (Passes 2.2 cfs of 6.8 cfs potential flow)
  ├─**3=Orifice/Grate** (Orifice Controls 2.2 cfs @ 3.62 fps)
  ├─**4=Orifice/Grate** (Controls 0.0 cfs)
  └─**5=Sharp-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 1P: Inf Syst-1



Summary for Pond 3P: Rain garden

Inflow Area = 12,275 sf, 52.50% Impervious, Inflow Depth = 4.90" for 10-Year event
Inflow = 1.6 cfs @ 12.09 hrs, Volume= 5,013 cf
Outflow = 1.6 cfs @ 12.09 hrs, Volume= 5,013 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.0 cfs @ 12.09 hrs, Volume= 477 cf
Primary = 1.6 cfs @ 12.09 hrs, Volume= 4,537 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 6.45' @ 12.09 hrs Surf.Area= 429 sf Storage= 229 cf

Plug-Flow detention time= 53.5 min calculated for 5,012 cf (100% of inflow)
Center-of-Mass det. time= 53.6 min (846.0 - 792.4)

Volume	Invert	Avail.Storage	Storage Description
#1	5.60'	253 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

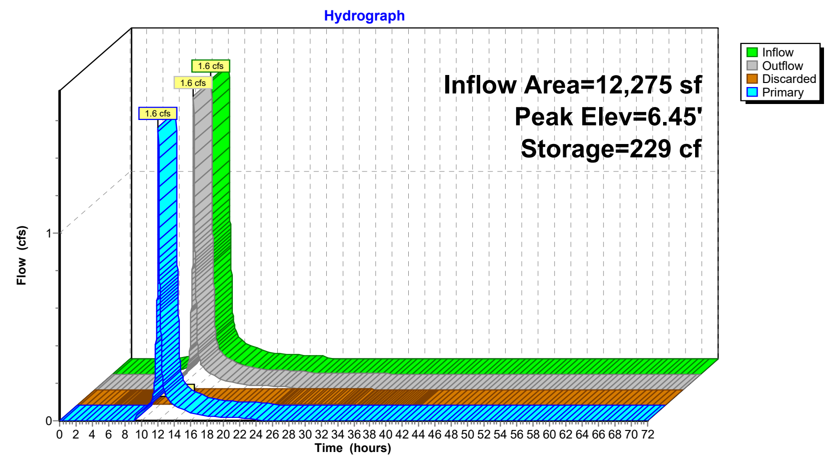
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.60	125	46.0	0	0	125
6.00	276	66.0	78	78	305
6.30	350	73.0	94	172	385
6.50	460	87.0	81	253	564

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.60'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	6.35'	**22.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.0 cfs @ 12.09 hrs HW=6.45' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=1.6 cfs @ 12.09 hrs HW=6.45' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 1.6 cfs @ 0.73 fps)

Pond 3P: Rain garden



Summary for Pond 4P: Inf Syst-2

Inflow Area = 1,112 sf, 95.68% Impervious, Inflow Depth = 6.04" for 10-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 560 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 547 cf, Atten= 1%, Lag= 0.6 min
Discarded = 0.0 cfs @ 2.79 hrs, Volume= 159 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 388 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.47' @ 12.09 hrs Surf.Area= 101 sf Storage= 131 cf

Plug-Flow detention time= 483.5 min calculated for 546 cf (98% of inflow)
Center-of-Mass det. time= 468.6 min (1,219.5 - 751.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

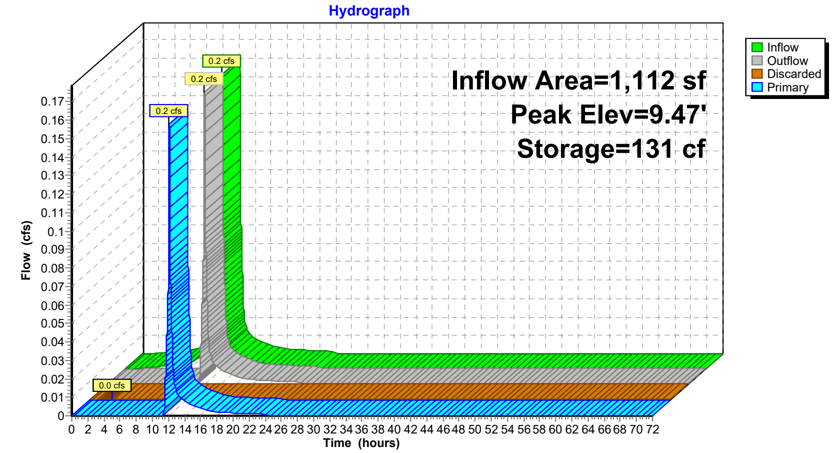
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.23'	**6.0" Round Culvert** L= 33.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.23' / 8.72' S= 0.0155 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 2.79 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.47' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.2 cfs @ 1.67 fps)

Pond 4P: Inf Syst-2



Summary for Pond 5P: Inf Syst-3

Inflow Area = 1,105 sf, 97.29% Impervious, Inflow Depth = 6.04" for 10-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 556 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 537 cf, Atten= 1%, Lag= 0.6 min
Discarded = 0.0 cfs @ 2.83 hrs, Volume= 159 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 379 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.61' @ 12.09 hrs Surf.Area= 101 sf Storage= 137 cf

Plug-Flow detention time= 497.7 min calculated for 537 cf (97% of inflow)
Center-of-Mass det. time= 476.9 min (1,227.8 - 751.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A**
			274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1
			Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf
			Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf
			10 Chambers in 2 Rows
		141 cf	Total Available Storage

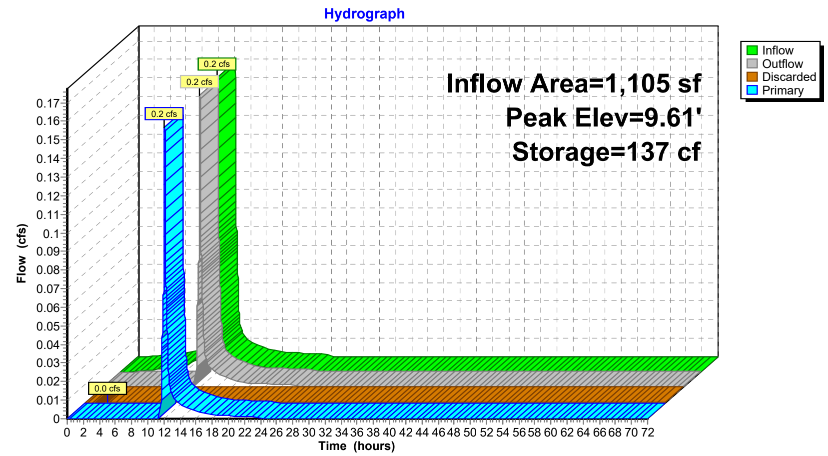
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.37'	**6.0" Round Culvert**
			L= 33.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 9.37' / 8.73' S= 0.0194 '/' Cc= 0.900
			n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 2.83 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.61' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.2 cfs @ 1.67 fps)

Pond 5P: Inf Syst-3



Summary for Pond 6P: Inf Syst-4

Inflow Area = 1,104 sf, 97.46% Impervious, Inflow Depth = 6.04" for 10-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 556 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 537 cf, Atten= 1%, Lag= 0.6 min
Discarded = 0.0 cfs @ 2.83 hrs, Volume= 159 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 378 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.61' @ 12.09 hrs Surf.Area= 101 sf Storage= 137 cf

Plug-Flow detention time= 498.4 min calculated for 537 cf (97% of inflow)
Center-of-Mass det. time= 477.3 min (1,228.2 - 751.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

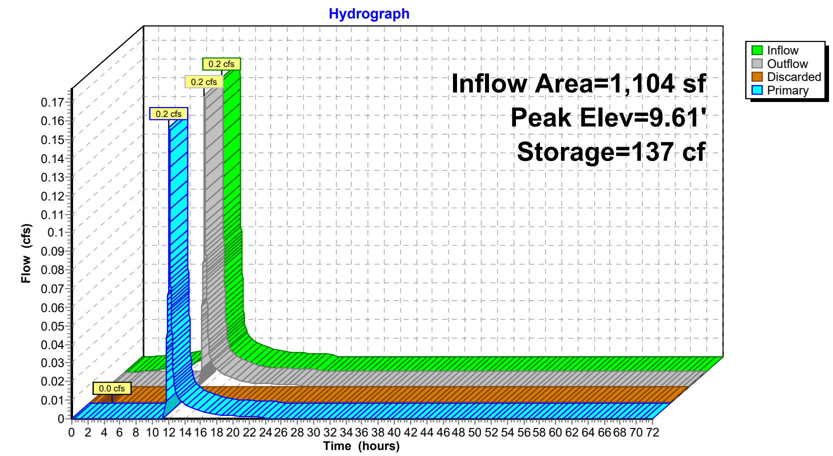
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.37'	**6.0" Round Culvert** L= 51.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.37' / 8.10' S= 0.0249 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 2.83 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.61' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.2 cfs @ 1.67 fps)

Pond 6P: Inf Syst-4



Summary for Pond 7P: Inf Syst-5

Inflow Area = 1,082 sf, 98.06% Impervious, Inflow Depth = 6.16" for 10-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 556 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 555 cf, Atten= 1%, Lag= 0.6 min
Discarded = 0.0 cfs @ 2.12 hrs, Volume= 160 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 395 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.24' @ 12.09 hrs Surf.Area= 101 sf Storage= 119 cf

Plug-Flow detention time= 464.5 min calculated for 555 cf (100% of inflow)
Center-of-Mass det. time= 463.9 min (1,208.1 - 744.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A**
			241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1
			Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf
			Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf
			10 Chambers in 2 Rows
		125 cf	Total Available Storage

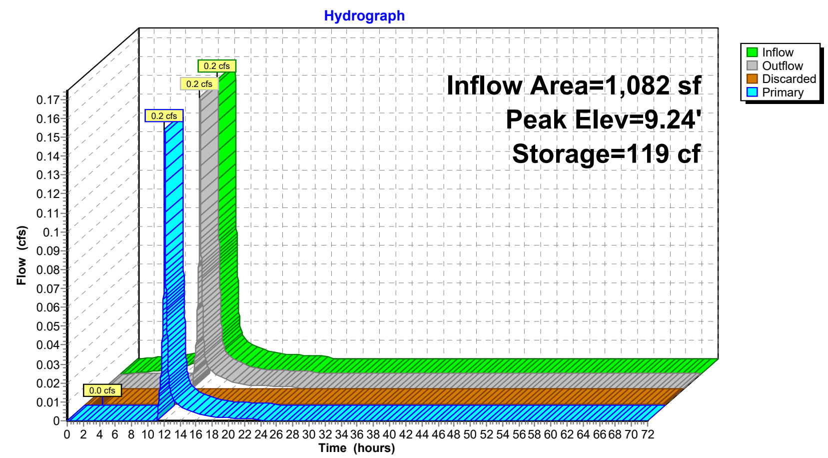
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**6.0" Round Culvert**
			L= 48.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 9.00' / 8.35' S= 0.0135 '/' Cc= 0.900
			n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 2.12 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.24' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.2 cfs @ 1.66 fps)

Pond 7P: Inf Syst-5



Summary for Pond 8P: Inf Syst-6

Inflow Area = 1,056 sf, 99.24% Impervious, Inflow Depth = 6.16" for 10-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 542 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 541 cf, Atten= 1%, Lag= 0.6 min
Discarded = 0.0 cfs @ 2.19 hrs, Volume= 160 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 382 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.26' @ 12.09 hrs Surf.Area= 101 sf Storage= 120 cf

Plug-Flow detention time= 475.6 min calculated for 541 cf (100% of inflow)
Center-of-Mass det. time= 474.9 min (1,219.1 - 744.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A** 241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1 Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf 10 Chambers in 2 Rows
		125 cf	Total Available Storage

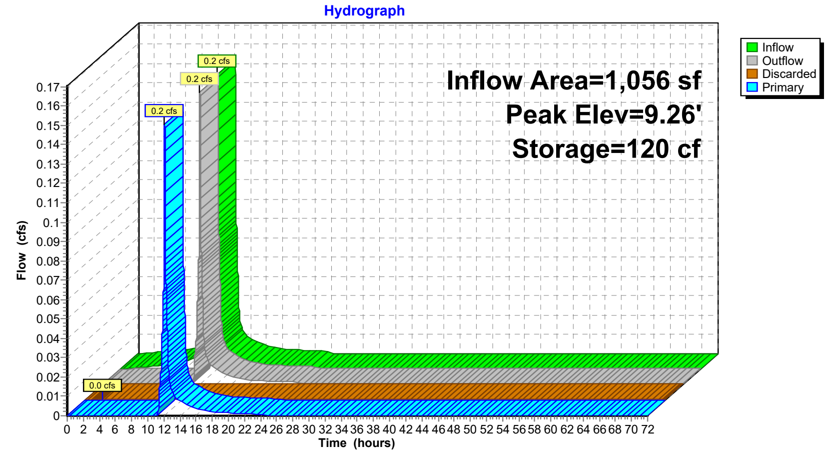
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**8.0" Round Culvert** L= 46.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.00' / 8.77' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 2.19 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.1 cfs @ 12.09 hrs HW=9.26' (Free Discharge)
└─**2=Culvert** (Barrel Controls 0.1 cfs @ 1.80 fps)

Pond 8P: Inf Syst-6



Summary for Pond 9P: Inf Syst-7

Inflow Area = 24,131 sf, 72.87% Impervious, Inflow Depth = 5.37" for 10-Year event
Inflow = 3.3 cfs @ 12.08 hrs, Volume= 10,797 cf
Outflow = 2.1 cfs @ 12.18 hrs, Volume= 10,797 cf, Atten= 37%, Lag= 5.7 min
Discarded = 0.0 cfs @ 5.84 hrs, Volume= 1,502 cf
Primary = 2.1 cfs @ 12.18 hrs, Volume= 9,295 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 8.14' @ 12.18 hrs Surf.Area= 2,422 sf Storage= 2,069 cf

Plug-Flow detention time= 63.5 min calculated for 10,795 cf (100% of inflow)
Center-of-Mass det. time= 63.5 min (841.9 - 778.3)

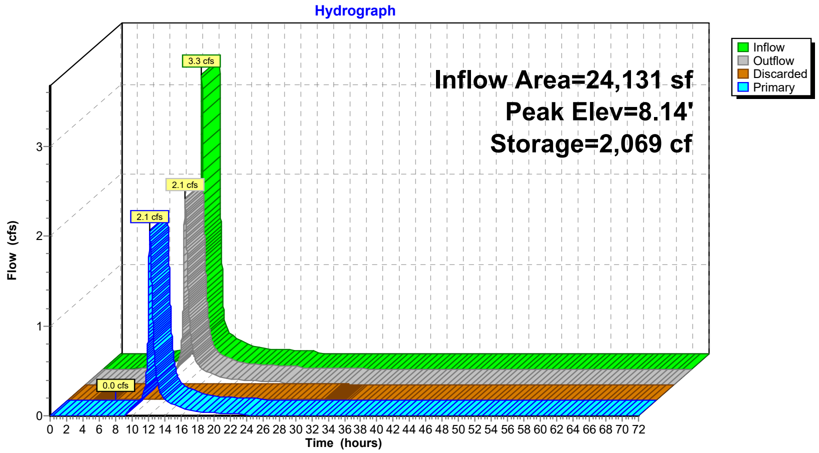
Volume	Invert	Avail.Storage	Storage Description
#1	7.15'	3,645 cf	**6.89'W x 14.06'L x 1.75'H StormTrap ST-1 Units (Irregular Shape)** x 25 4,238 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.15'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	7.15'	**12.0" Round Culvert** L= 4.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.15' / 7.13' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	7.35'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 5.84 hrs HW=7.17' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=2.1 cfs @ 12.18 hrs HW=8.14' (Free Discharge)
└**2=Culvert** (Barrel Controls 2.1 cfs @ 3.29 fps)
  └**3=Orifice/Grate** (Passes 2.1 cfs of 2.3 cfs potential flow)

Pond 9P: Inf Syst-7

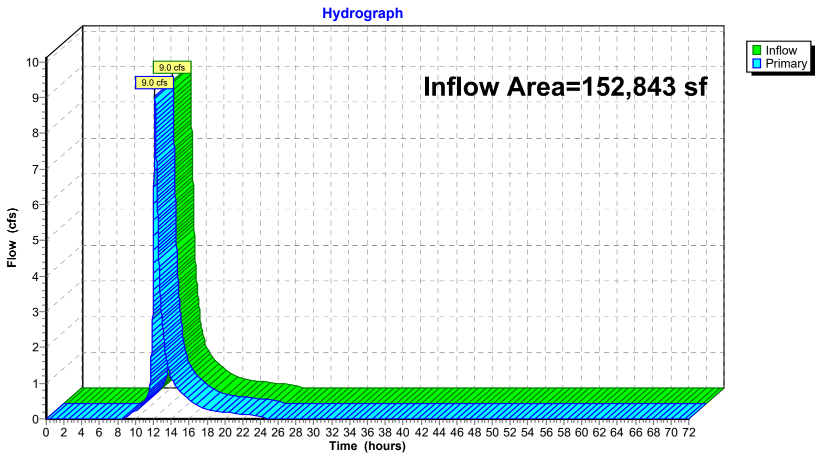


Summary for Link 1L: Towards Wetlands

Inflow Area = 152,843 sf, 50.79% Impervious, Inflow Depth = 3.48" for 10-Year event
Inflow = 9.0 cfs @ 12.18 hrs, Volume= 44,377 cf
Primary = 9.0 cfs @ 12.18 hrs, Volume= 44,377 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 1L: Towards Wetlands

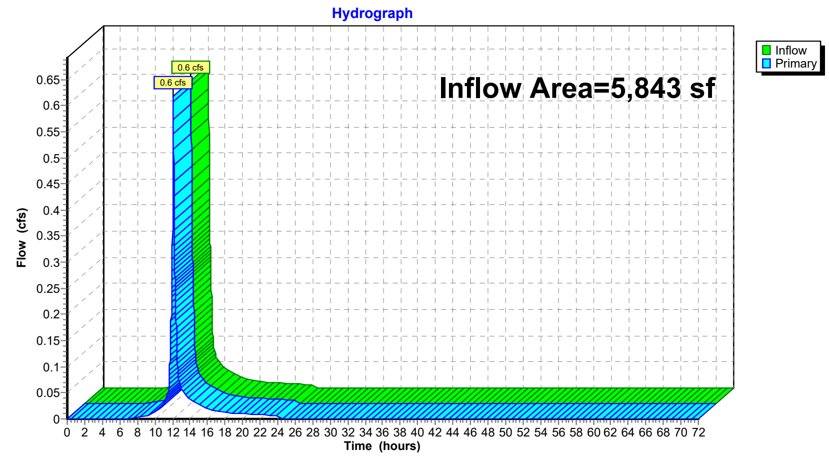


Summary for Link 2L: Towards Street

Inflow Area = 5,843 sf, 18.07% Impervious, Inflow Depth = 3.93" for 10-Year event
Inflow = 0.6 cfs @ 12.09 hrs, Volume= 1,916 cf
Primary = 0.6 cfs @ 12.09 hrs, Volume= 1,916 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 2L: Towards Street

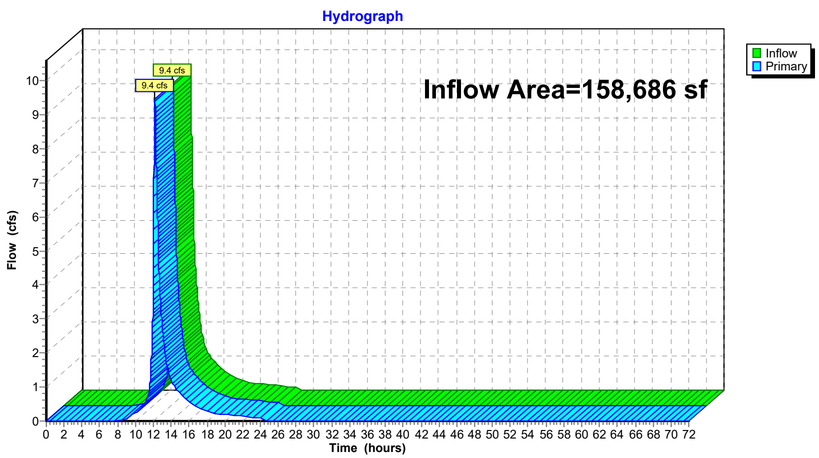


Summary for Link 100L: Total Flows

Inflow Area =	158,686 sf, 49.59% Impervious, Inflow Depth = 3.50" for 10-Year event	
Inflow =	9.4 cfs @ 12.17 hrs, Volume=	46,293 cf
Primary =	9.4 cfs @ 12.17 hrs, Volume=	46,293 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 100L: Total Flows



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: CB-1	Runoff Area=22,742 sf 72.16% Impervious Runoff Depth=7.22" Tc=6.0 min CN=91 Runoff=4.1 cfs 13,685 cf
Subcatchment2S: Building Roof	Runoff Area=32,925 sf 100.00% Impervious Runoff Depth=8.06" Tc=6.0 min CN=98 Runoff=6.2 cfs 22,115 cf
Subcatchment3.1S: Backyard ADs	Runoff Area=8,985 sf 3.03% Impervious Runoff Depth=5.31" Flow Length=147' Tc=10.3 min CN=75 Runoff=1.1 cfs 3,978 cf
Subcatchment3S: Townhouse Roofs	Runoff Area=13,067 sf 100.00% Impervious Runoff Depth=8.06" Tc=6.0 min CN=98 Runoff=2.4 cfs 8,777 cf
Subcatchment4.2S: TD-2	Runoff Area=1,112 sf 95.68% Impervious Runoff Depth=7.94" Tc=6.0 min CN=97 Runoff=0.2 cfs 736 cf
Subcatchment4.3S: TD-3	Runoff Area=1,105 sf 97.29% Impervious Runoff Depth=7.94" Tc=6.0 min CN=97 Runoff=0.2 cfs 731 cf
Subcatchment4.4S: TD-4	Runoff Area=1,104 sf 97.46% Impervious Runoff Depth=7.94" Tc=6.0 min CN=97 Runoff=0.2 cfs 730 cf
Subcatchment4.5S: TD-5	Runoff Area=1,082 sf 98.06% Impervious Runoff Depth=8.06" Tc=6.0 min CN=98 Runoff=0.2 cfs 727 cf
Subcatchment4.6S: TD-6	Runoff Area=1,056 sf 99.24% Impervious Runoff Depth=8.06" Tc=6.0 min CN=98 Runoff=0.2 cfs 709 cf
Subcatchment5.1S: TD-1A	Runoff Area=1,389 sf 84.59% Impervious Runoff Depth=7.58" Tc=6.0 min CN=94 Runoff=0.3 cfs 877 cf
Subcatchment5S: TD-1B	Runoff Area=4,462 sf 42.78% Impervious Runoff Depth=6.38" Tc=6.0 min CN=84 Runoff=0.7 cfs 2,374 cf
Subcatchment6.1S: East driveway	Runoff Area=12,275 sf 52.50% Impervious Runoff Depth=6.74" Tc=6.0 min CN=87 Runoff=2.1 cfs 6,897 cf
Subcatchment6S: Bypass Towards	Runoff Area=51,539 sf 0.21% Impervious Runoff Depth=5.19" Flow Length=125' Tc=14.0 min CN=74 Runoff=5.6 cfs 22,311 cf
Subcatchment7S: To Street	Runoff Area=5,843 sf 18.07% Impervious Runoff Depth=5.67" Tc=6.0 min CN=78 Runoff=0.9 cfs 2,760 cf
Pond 1P: Inf Syst-1	Peak Elev=10.41' Storage=15,470 cf Inflow=10.6 cfs 37,649 cf Discarded=0.1 cfs 14,969 cf Primary=4.1 cfs 22,680 cf Outflow=4.2 cfs 37,649 cf
Pond 3P: Rain garden	Peak Elev=6.47' Storage=239 cf Inflow=2.1 cfs 6,897 cf Discarded=0.0 cfs 495 cf Primary=2.1 cfs 6,401 cf Outflow=2.1 cfs 6,897 cf

Pond 4P: Inf Syst-2 Peak Elev=9.51' Storage=133 cf Inflow=0.2 cfs 736 cf
Discarded=0.0 cfs 160 cf Primary=0.2 cfs 562 cf Outflow=0.2 cfs 722 cf

Pond 5P: Inf Syst-3 Peak Elev=9.65' Storage=139 cf Inflow=0.2 cfs 731 cf
Discarded=0.0 cfs 160 cf Primary=0.2 cfs 552 cf Outflow=0.2 cfs 712 cf

Pond 6P: Inf Syst-4 Peak Elev=9.65' Storage=139 cf Inflow=0.2 cfs 730 cf
Discarded=0.0 cfs 160 cf Primary=0.2 cfs 552 cf Outflow=0.2 cfs 711 cf

Pond 7P: Inf Syst-5 Peak Elev=9.28' Storage=121 cf Inflow=0.2 cfs 727 cf
Discarded=0.0 cfs 161 cf Primary=0.2 cfs 565 cf Outflow=0.2 cfs 726 cf

Pond 8P: Inf Syst-6 Peak Elev=9.29' Storage=122 cf Inflow=0.2 cfs 709 cf
Discarded=0.0 cfs 161 cf Primary=0.2 cfs 548 cf Outflow=0.2 cfs 708 cf

Pond 9P: Inf Syst-7 Peak Elev=8.38' Storage=2,562 cf Inflow=4.3 cfs 14,562 cf
Discarded=0.0 cfs 1,561 cf Primary=2.7 cfs 13,001 cf Outflow=2.7 cfs 14,562 cf

Link 1L: Towards Wetlands Inflow=13.7 cfs 66,767 cf
Primary=13.7 cfs 66,767 cf

Link 2L: Towards Street Inflow=0.9 cfs 2,760 cf
Primary=0.9 cfs 2,760 cf

Link 100L: Total Flows Inflow=14.2 cfs 69,527 cf
Primary=14.2 cfs 69,527 cf

Total Runoff Area = 158,686 sf Runoff Volume = 87,407 cf Average Runoff Depth = 6.61"
50.41% Pervious = 79,997 sf 49.59% Impervious = 78,689 sf

Summary for Subcatchment 1S: CB-1

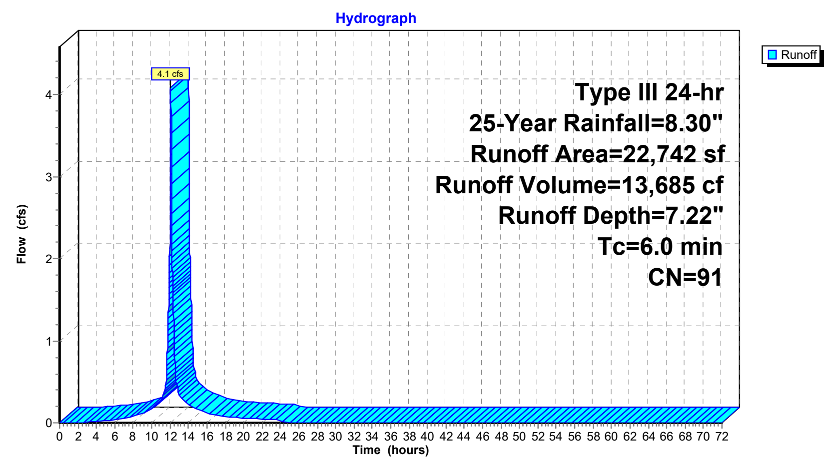
Runoff = 4.1 cfs @ 12.08 hrs, Volume= 13,685 cf, Depth= 7.22"
Routed to Pond 9P : Inf Syst-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
16,410	98	Paved parking, HSG C
6,332	74	>75% Grass cover, Good, HSG C
22,742	91	Weighted Average
6,332		27.84% Pervious Area
16,410		72.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 1S: CB-1



Summary for Subcatchment 2S: Building Roof

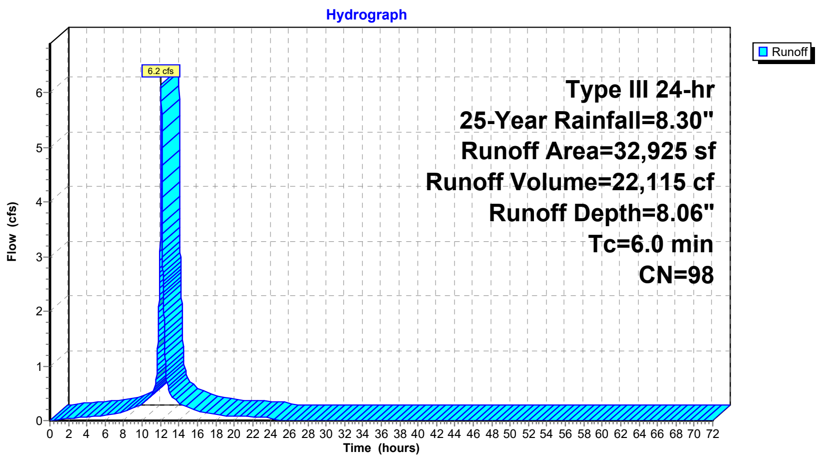
Runoff = 6.2 cfs @ 12.08 hrs, Volume= 22,115 cf, Depth= 8.06"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
32,925	98	Roofs, HSG C
32,925		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 2S: Building Roof



Summary for Subcatchment 3.1S: Backyard ADs

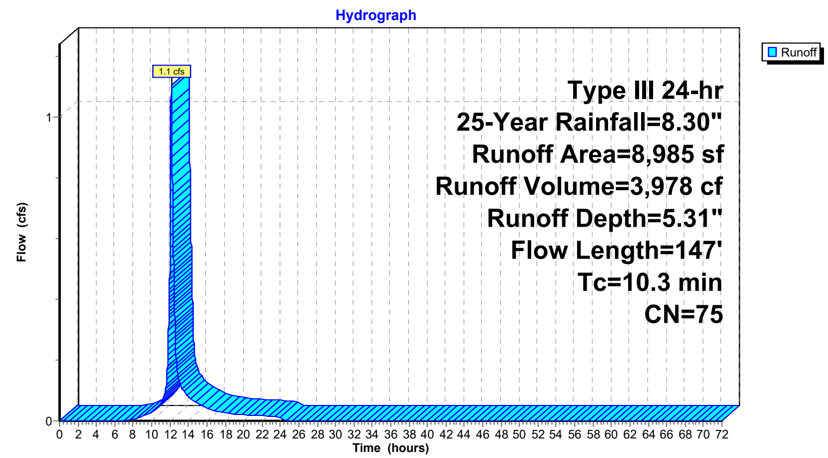
Runoff = 1.1 cfs @ 12.14 hrs, Volume= 3,978 cf, Depth= 5.31"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

	Area (sf)	CN	Description
	272	98	Unconnected pavement, HSG C
	8,302	74	>75% Grass cover, Good, HSG C
*	411	89	Gravel sidewalk, HSG C
	8,985	75	Weighted Average
	8,713		96.97% Pervious Area
	272		3.03% Impervious Area
	272		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	50	0.0142	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.23"
0.9	97	0.0154	1.86		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
10.3	147	Total			

Subcatchment 3.1S: Backyard ADs



Summary for Subcatchment 3S: Townhouse Roofs

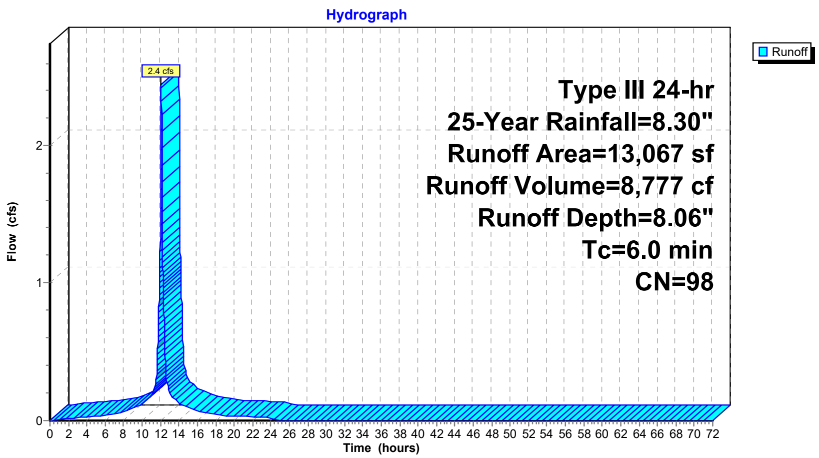
Runoff = 2.4 cfs @ 12.08 hrs, Volume= 8,777 cf, Depth= 8.06"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
13,067	98	Roofs, HSG C
13,067		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 3S: Townhouse Roofs



Summary for Subcatchment 4.2S: TD-2

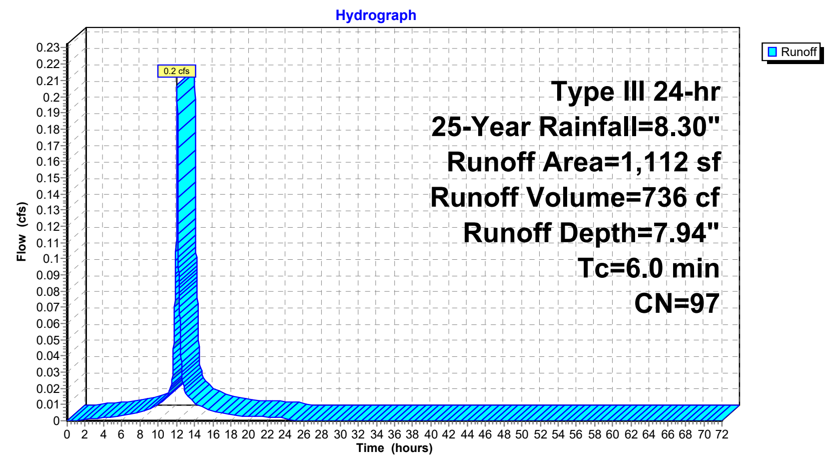
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 736 cf, Depth= 7.94"
Routed to Pond 4P : Inf Syst-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
1,064	98	Paved parking, HSG C
48	74	>75% Grass cover, Good, HSG C
1,112	97	Weighted Average
48		4.32% Pervious Area
1,064		95.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.2S: TD-2



Summary for Subcatchment 4.3S: TD-3

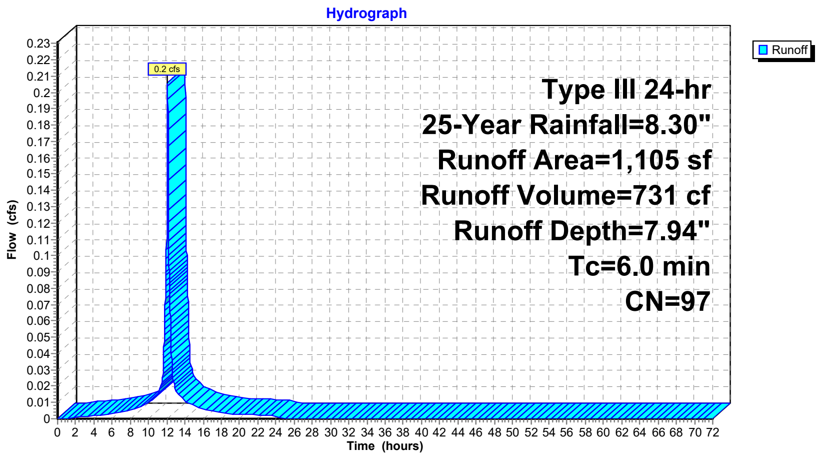
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 731 cf, Depth= 7.94"
Routed to Pond 5P : Inf Syst-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
1,075	98	Paved parking, HSG C
30	74	>75% Grass cover, Good, HSG C
1,105	97	Weighted Average
30		2.71% Pervious Area
1,075		97.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.3S: TD-3



Summary for Subcatchment 4.4S: TD-4

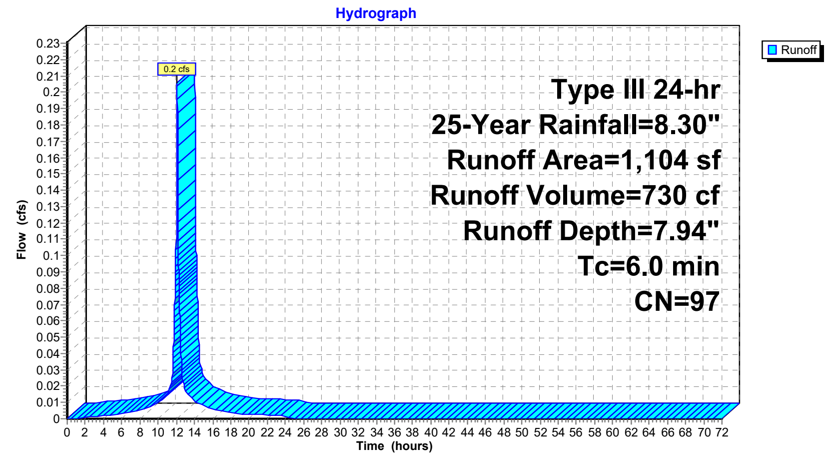
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 730 cf, Depth= 7.94"
Routed to Pond 6P : Inf Syst-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
1,076	98	Paved parking, HSG C
28	74	>75% Grass cover, Good, HSG C
1,104	97	Weighted Average
28		2.54% Pervious Area
1,076		97.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.4S: TD-4



Summary for Subcatchment 4.5S: TD-5

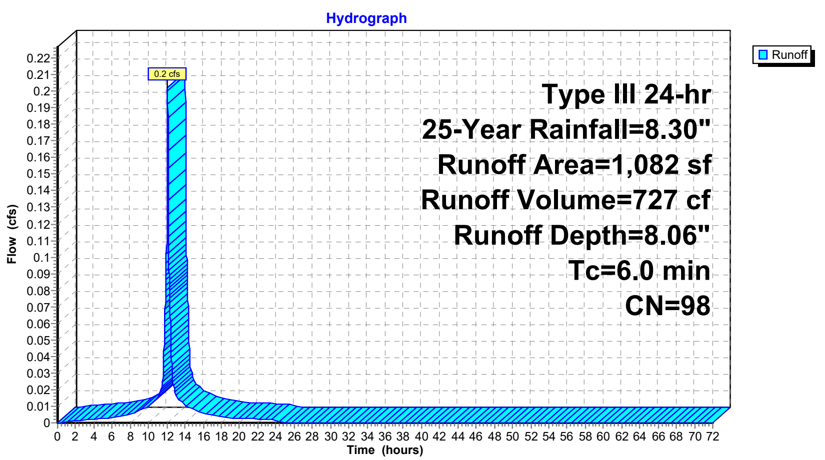
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 727 cf, Depth= 8.06"
Routed to Pond 7P : Inf Syst-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
1,061	98	Paved parking, HSG C
21	74	>75% Grass cover, Good, HSG C
1,082	98	Weighted Average
21		1.94% Pervious Area
1,061		98.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.5S: TD-5



Summary for Subcatchment 4.6S: TD-6

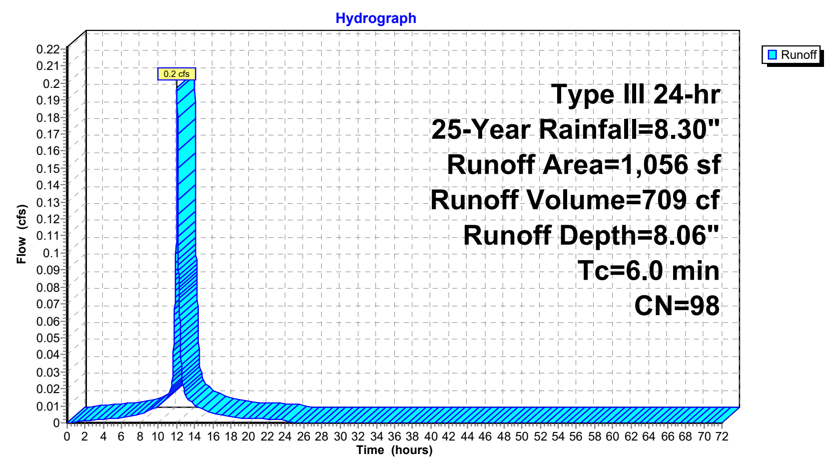
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 709 cf, Depth= 8.06"
Routed to Pond 8P : Inf Syst-6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
1,048	98	Paved parking, HSG C
8	74	>75% Grass cover, Good, HSG C
1,056	98	Weighted Average
8		0.76% Pervious Area
1,048		99.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.6S: TD-6



Summary for Subcatchment 5.1S: TD-1A

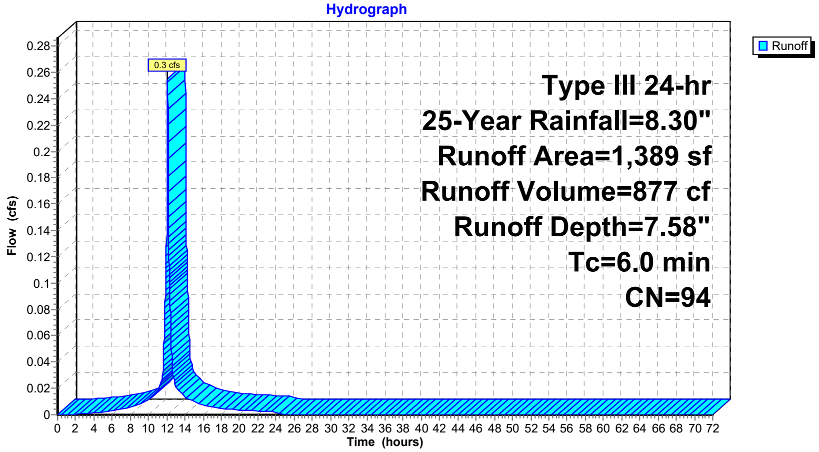
Runoff = 0.3 cfs @ 12.08 hrs, Volume= 877 cf, Depth= 7.58"
Routed to Pond 9P : Inf Syst-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
1,175	98	Paved parking, HSG C
214	74	>75% Grass cover, Good, HSG C
1,389	94	Weighted Average
214		15.41% Pervious Area
1,175		84.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 5.1S: TD-1A



Summary for Subcatchment 5S: TD-1B

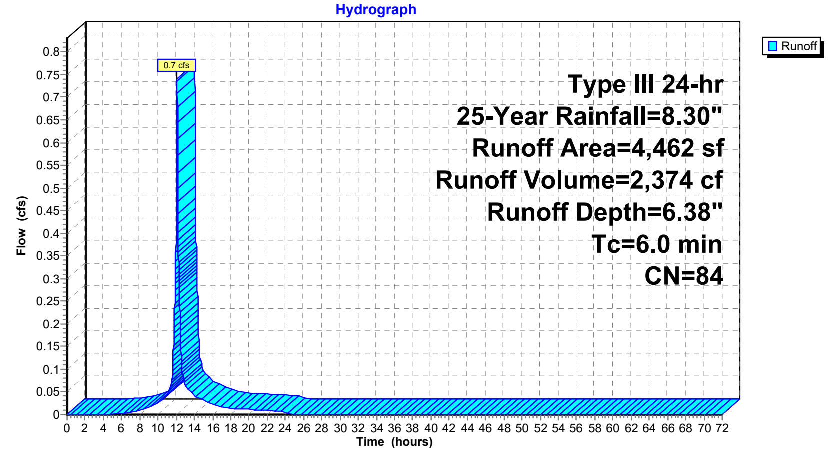
Runoff = 0.7 cfs @ 12.09 hrs, Volume= 2,374 cf, Depth= 6.38"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
1,909	98	Paved parking, HSG C
2,553	74	>75% Grass cover, Good, HSG C
4,462	84	Weighted Average
2,553		57.22% Pervious Area
1,909		42.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 5S: TD-1B



Summary for Subcatchment 6.1S: East driveway

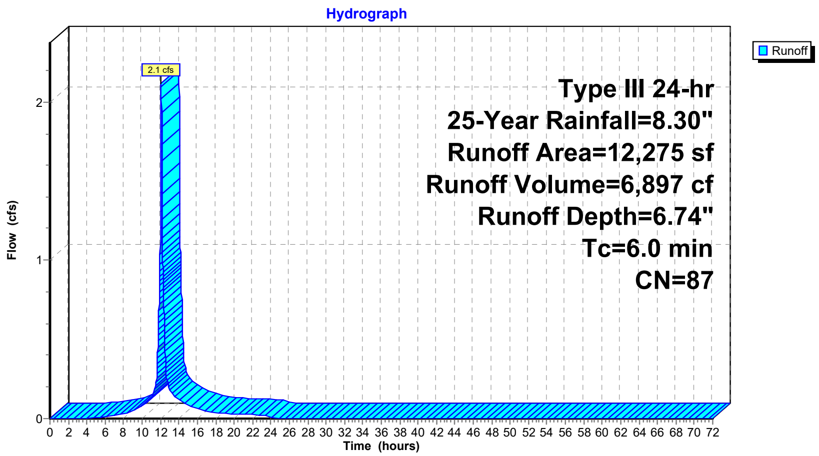
Runoff = 2.1 cfs @ 12.08 hrs, Volume= 6,897 cf, Depth= 6.74"
Routed to Pond 3P : Rain garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
5,611	74	>75% Grass cover, Good, HSG C
6,444	98	Paved roads w/curbs & sewers, HSG C
220	89	Gravel roads, HSG C
12,275	87	Weighted Average
5,831		47.50% Pervious Area
6,444		52.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 6.1S: East driveway



Summary for Subcatchment 6S: Bypass Towards Wetlands

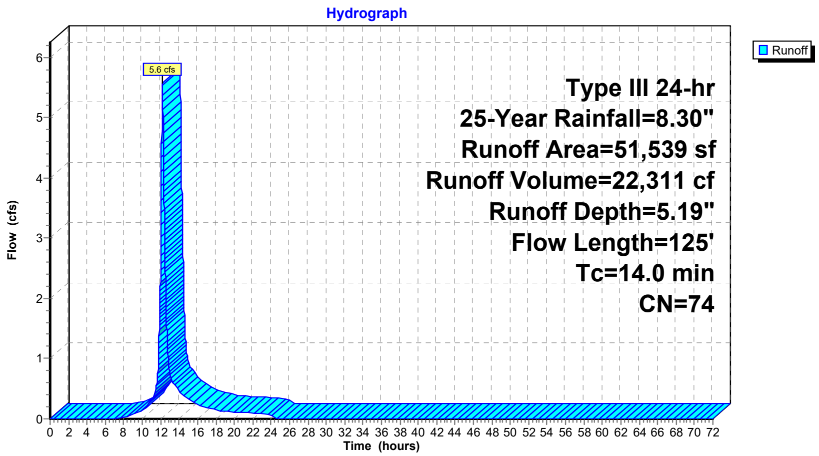
Runoff = 5.6 cfs @ 12.19 hrs, Volume= 22,311 cf, Depth= 5.19"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
4,985	70	Woods, Good, HSG C
46,447	74	>75% Grass cover, Good, HSG C
107	98	Roofs, HSG C
51,539	74	Weighted Average
51,432		99.79% Pervious Area
107		0.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	50	0.0220	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
2.2	75	0.0133	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	125	Total			

Subcatchment 6S: Bypass Towards Wetlands



Summary for Subcatchment 7S: To Street

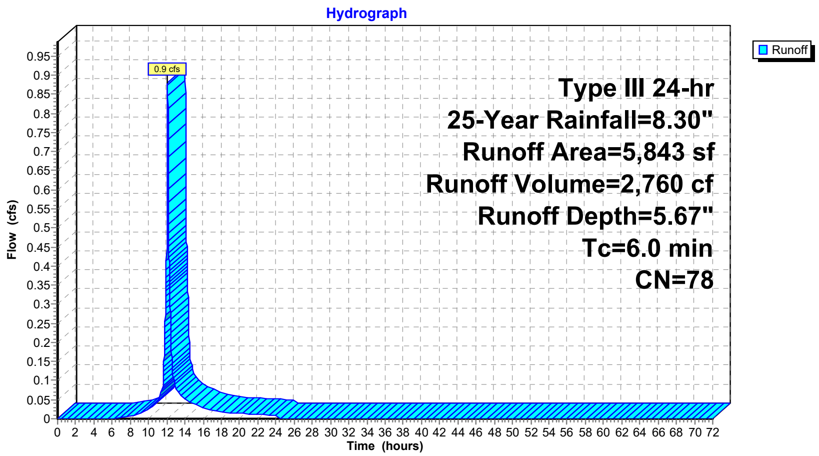
Runoff = 0.9 cfs @ 12.09 hrs, Volume= 2,760 cf, Depth= 5.67"
Routed to Link 2L : Towards Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
1,056	98	Paved parking, HSG C
4,787	74	>75% Grass cover, Good, HSG C
5,843	78	Weighted Average
4,787		81.93% Pervious Area
1,056		18.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 7S: To Street



Summary for Pond 1P: Inf Syst-1

Inflow Area = 60,436 sf, 85.36% Impervious, Inflow Depth = 7.48" for 25-Year event
Inflow = 10.6 cfs @ 12.09 hrs, Volume= 37,649 cf
Outflow = 4.2 cfs @ 12.32 hrs, Volume= 37,649 cf, Atten= 60%, Lag= 14.1 min
Discarded = 0.1 cfs @ 4.33 hrs, Volume= 14,969 cf
Primary = 4.1 cfs @ 12.32 hrs, Volume= 22,680 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 10.41' @ 12.32 hrs Surf.Area= 7,459 sf Storage= 15,470 cf

Plug-Flow detention time= 354.1 min calculated for 37,649 cf (100% of inflow)
Center-of-Mass det. time= 354.1 min (1,107.3 - 753.2)

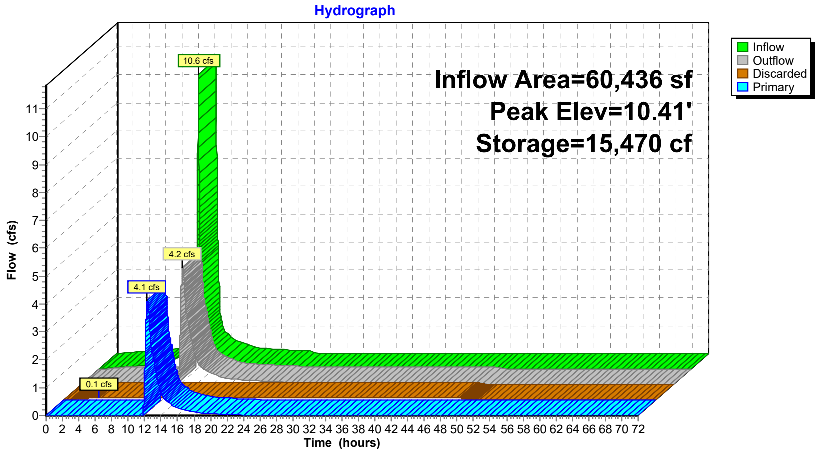
Volume	Invert	Avail.Storage	Storage Description
#1	8.00'	19,245 cf	**6.89'W x 14.06'L x 3.00'H StormTrap ST-1 Units (Irregular Shape)** x 77 22,378 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	8.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	8.00'	**15.0" Round Culvert** L= 26.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 8.00' / 7.13' S= 0.0335 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#3	Device 2	9.22'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	10.05'	**20.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 2	10.79'	**3.7' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.1 cfs @ 4.33 hrs HW=8.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=4.1 cfs @ 12.32 hrs HW=10.41' (Free Discharge)
└**2=Culvert** (Passes 4.1 cfs of 7.9 cfs potential flow)
├**3=Orifice/Grate** (Orifice Controls 3.0 cfs @ 4.87 fps)
├**4=Orifice/Grate** (Orifice Controls 1.1 cfs @ 2.05 fps)
└**5=Sharp-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 1P: Inf Syst-1



Summary for Pond 3P: Rain garden

Inflow Area = 12,275 sf, 52.50% Impervious, Inflow Depth = 6.74" for 25-Year event
Inflow = 2.1 cfs @ 12.08 hrs, Volume= 6,897 cf
Outflow = 2.1 cfs @ 12.09 hrs, Volume= 6,897 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.0 cfs @ 12.09 hrs, Volume= 495 cf
Primary = 2.1 cfs @ 12.09 hrs, Volume= 6,401 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 6.47' @ 12.09 hrs Surf.Area= 442 sf Storage= 239 cf

Plug-Flow detention time= 40.9 min calculated for 6,896 cf (100% of inflow)
Center-of-Mass det. time= 41.0 min (824.8 - 783.8)

Volume	Invert	Avail.Storage	Storage Description
#1	5.60'	253 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

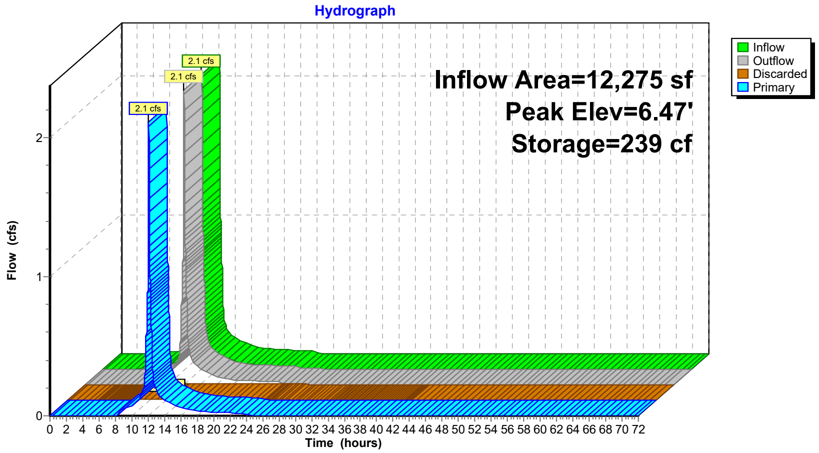
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.60	125	46.0	0	0	125
6.00	276	66.0	78	78	305
6.30	350	73.0	94	172	385
6.50	460	87.0	81	253	564

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.60'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	6.35'	**22.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.0 cfs @ 12.09 hrs HW=6.47' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=2.1 cfs @ 12.09 hrs HW=6.47' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 2.1 cfs @ 0.81 fps)

Pond 3P: Rain garden



Summary for Pond 4P: Inf Syst-2

Inflow Area = 1,112 sf, 95.68% Impervious, Inflow Depth = 7.94" for 25-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 736 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 722 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 2.05 hrs, Volume= 160 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 562 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.51' @ 12.09 hrs Surf.Area= 101 sf Storage= 133 cf

Plug-Flow detention time= 377.3 min calculated for 722 cf (98% of inflow)
Center-of-Mass det. time= 365.7 min (1,112.2 - 746.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

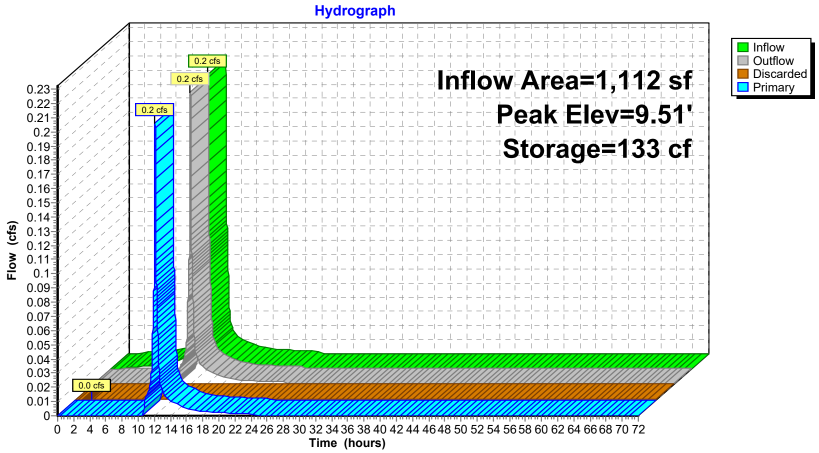
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.23'	**6.0" Round Culvert** L= 33.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.23' / 8.72' S= 0.0155 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 2.05 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.51' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.2 cfs @ 1.81 fps)

Pond 4P: Inf Syst-2



Summary for Pond 5P: Inf Syst-3

Inflow Area = 1,105 sf, 97.29% Impervious, Inflow Depth = 7.94" for 25-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 731 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 712 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 2.08 hrs, Volume= 160 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 552 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.65' @ 12.09 hrs Surf.Area= 101 sf Storage= 139 cf

Plug-Flow detention time= 388.2 min calculated for 712 cf (97% of inflow)
Center-of-Mass det. time= 371.5 min (1,118.0 - 746.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

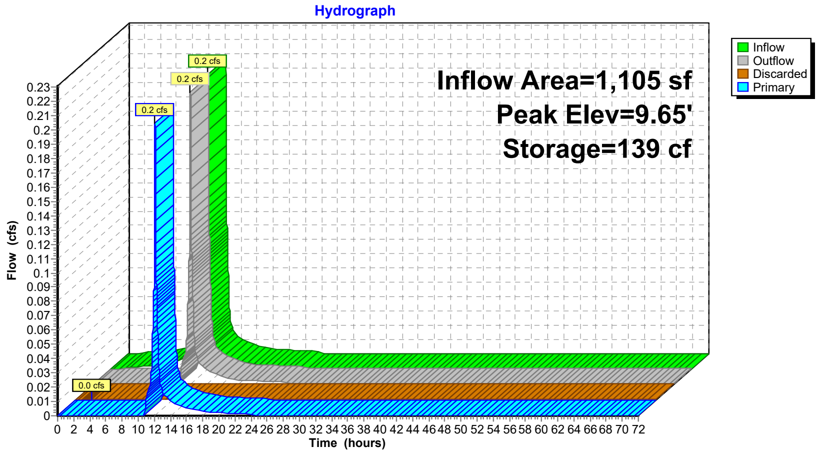
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.37'	**6.0" Round Culvert** L= 33.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.37' / 8.73' S= 0.0194 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 2.08 hrs HW=7.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.65' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.2 cfs @ 1.80 fps)

Pond 5P: Inf Syst-3



Summary for Pond 6P: Inf Syst-4

Inflow Area = 1,104 sf, 97.46% Impervious, Inflow Depth = 7.94" for 25-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 730 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 711 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 2.08 hrs, Volume= 160 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 552 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.65' @ 12.09 hrs Surf.Area= 101 sf Storage= 139 cf

Plug-Flow detention time= 388.1 min calculated for 711 cf (97% of inflow)
Center-of-Mass det. time= 371.8 min (1,118.4 - 746.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

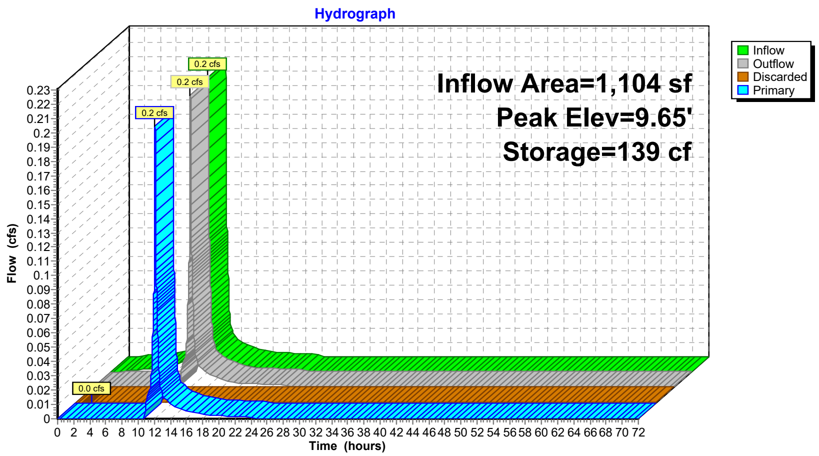
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.37'	**6.0" Round Culvert** L= 51.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.37' / 8.10' S= 0.0249 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 2.08 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.65' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.2 cfs @ 1.80 fps)

Pond 6P: Inf Syst-4



Summary for Pond 7P: Inf Syst-5

Inflow Area = 1,082 sf, 98.06% Impervious, Inflow Depth = 8.06" for 25-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 727 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 726 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.52 hrs, Volume= 161 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 565 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.28' @ 12.09 hrs Surf.Area= 101 sf Storage= 121 cf

Plug-Flow detention time= 365.7 min calculated for 726 cf (100% of inflow)
Center-of-Mass det. time= 365.2 min (1,106.0 - 740.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A**
			241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1
			Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf
			Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf
			10 Chambers in 2 Rows
		125 cf	Total Available Storage

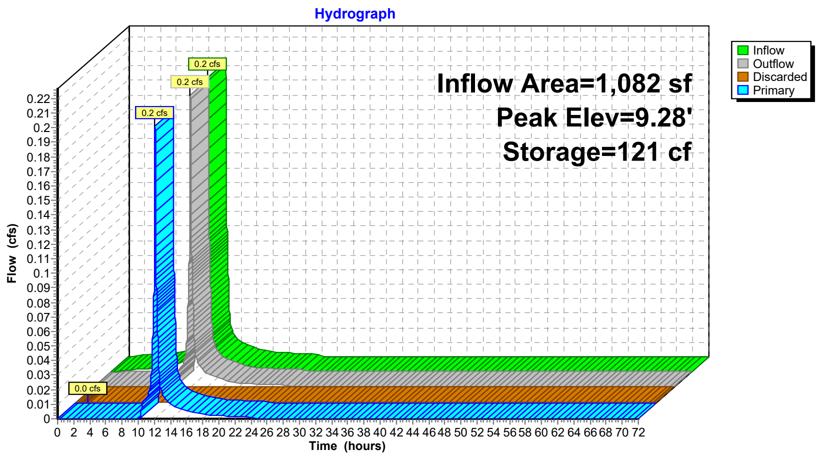
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**6.0" Round Culvert**
			L= 48.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 9.00' / 8.35' S= 0.0135 '/' Cc= 0.900
			n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 1.52 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.28' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.2 cfs @ 1.79 fps)

Pond 7P: Inf Syst-5



Summary for Pond 8P: Inf Syst-6

Inflow Area = 1,056 sf, 99.24% Impervious, Inflow Depth = 8.06" for 25-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 709 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 708 cf, Atten= 1%, Lag= 0.6 min
Discarded = 0.0 cfs @ 1.56 hrs, Volume= 161 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 548 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.29' @ 12.09 hrs Surf.Area= 101 sf Storage= 122 cf

Plug-Flow detention time= 374.4 min calculated for 708 cf (100% of inflow)
Center-of-Mass det. time= 373.8 min (1,114.6 - 740.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A** 241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1 Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf 10 Chambers in 2 Rows
		125 cf	Total Available Storage

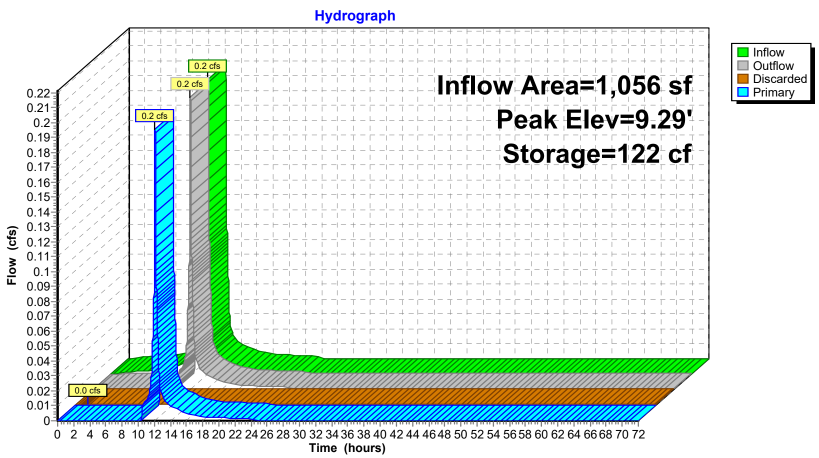
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**8.0" Round Culvert** L= 46.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.00' / 8.77' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 1.56 hrs HW=7.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.29' (Free Discharge)
└**2=Culvert** (Barrel Controls 0.2 cfs @ 1.94 fps)

Pond 8P: Inf Syst-6



Summary for Pond 9P: Inf Syst-7

Inflow Area = 24,131 sf, 72.87% Impervious, Inflow Depth = 7.24" for 25-Year event
Inflow = 4.3 cfs @ 12.08 hrs, Volume= 14,562 cf
Outflow = 2.7 cfs @ 12.18 hrs, Volume= 14,562 cf, Atten= 37%, Lag= 5.7 min
Discarded = 0.0 cfs @ 4.62 hrs, Volume= 1,561 cf
Primary = 2.7 cfs @ 12.18 hrs, Volume= 13,001 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 8.38' @ 12.18 hrs Surf.Area= 2,422 sf Storage= 2,562 cf

Plug-Flow detention time= 53.2 min calculated for 14,562 cf (100% of inflow)
Center-of-Mass det. time= 53.1 min (824.0 - 770.9)

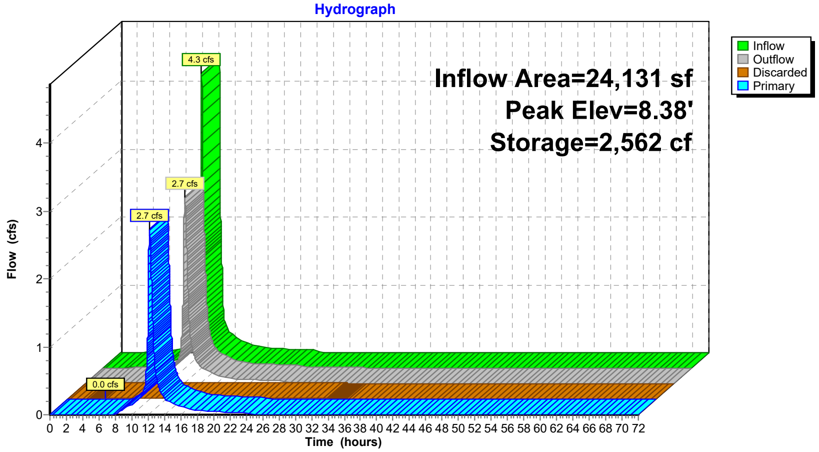
Volume	Invert	Avail.Storage	Storage Description
#1	7.15'	3,645 cf	**6.89'W x 14.06'L x 1.75'H StormTrap ST-1 Units (Irregular Shape)** x 25 4,238 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.15'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	7.15'	**12.0" Round Culvert** L= 4.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.15' / 7.13' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	7.35'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 4.62 hrs HW=7.17' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=2.7 cfs @ 12.18 hrs HW=8.38' (Free Discharge)
2=Culvert (Passes 2.7 cfs of 2.7 cfs potential flow)
3=Orifice/Grate (Orifice Controls 2.7 cfs @ 4.47 fps)

Pond 9P: Inf Syst-7

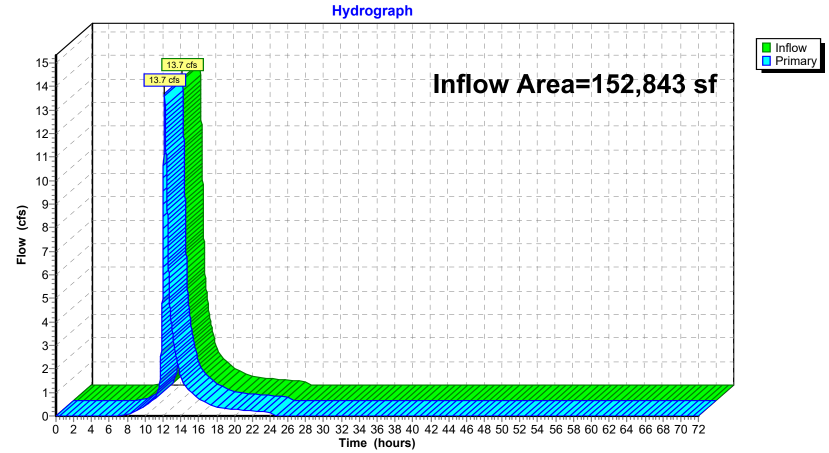


Summary for Link 1L: Towards Wetlands

Inflow Area = 152,843 sf, 50.79% Impervious, Inflow Depth = 5.24" for 25-Year event
Inflow = 13.7 cfs @ 12.18 hrs, Volume= 66,767 cf
Primary = 13.7 cfs @ 12.18 hrs, Volume= 66,767 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 1L: Towards Wetlands

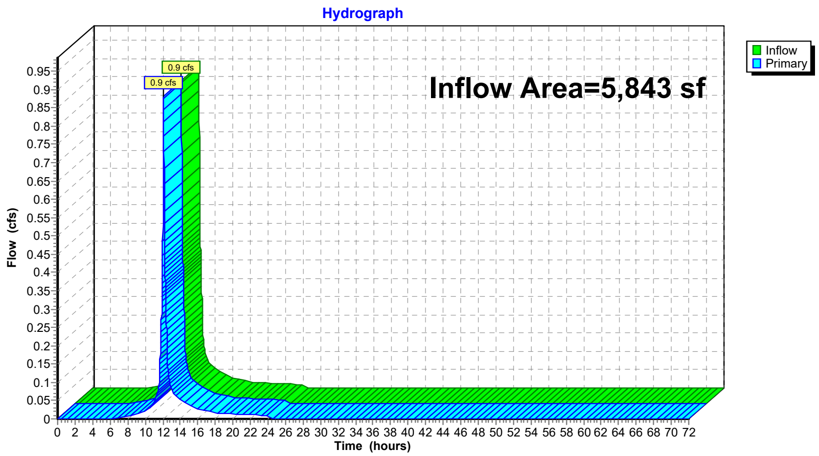


Summary for Link 2L: Towards Street

Inflow Area = 5,843 sf, 18.07% Impervious, Inflow Depth = 5.67" for 25-Year event
Inflow = 0.9 cfs @ 12.09 hrs, Volume= 2,760 cf
Primary = 0.9 cfs @ 12.09 hrs, Volume= 2,760 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 2L: Towards Street

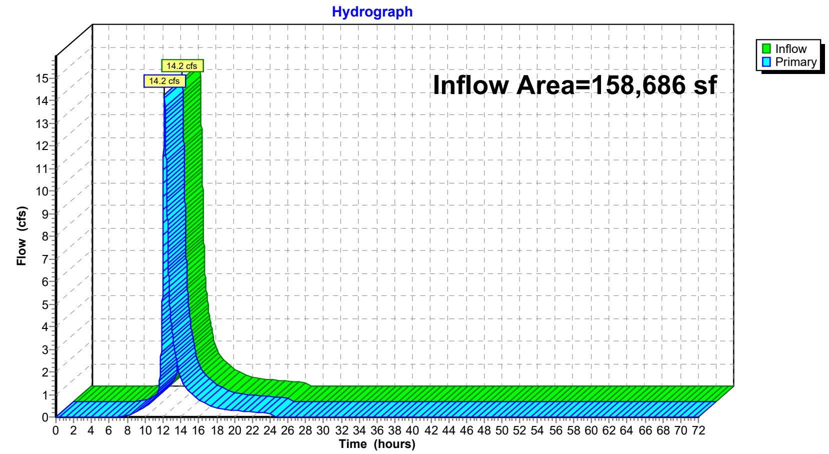


Summary for Link 100L: Total Flows

Inflow Area = 158,686 sf, 49.59% Impervious, Inflow Depth = 5.26" for 25-Year event
Inflow = 14.2 cfs @ 12.18 hrs, Volume= 69,527 cf
Primary = 14.2 cfs @ 12.18 hrs, Volume= 69,527 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 100L: Total Flows



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: CB-1 Runoff Area=22,742 sf 72.16% Impervious Runoff Depth=8.58"
Tc=6.0 min CN=91 Runoff=4.8 cfs 16,254 cf

Subcatchment2S: Building Roof Runoff Area=32,925 sf 100.00% Impervious Runoff Depth=9.43"
Tc=6.0 min CN=98 Runoff=7.2 cfs 25,872 cf

Subcatchment3.1S: Backyard ADs Runoff Area=8,985 sf 3.03% Impervious Runoff Depth=6.57"
Flow Length=147' Tc=10.3 min CN=75 Runoff=1.4 cfs 4,920 cf

Subcatchment3S: Townhouse Roofs Runoff Area=13,067 sf 100.00% Impervious Runoff Depth=9.43"
Tc=6.0 min CN=98 Runoff=2.9 cfs 10,268 cf

Subcatchment4.2S: TD-2 Runoff Area=1,112 sf 95.68% Impervious Runoff Depth=9.31"
Tc=6.0 min CN=97 Runoff=0.2 cfs 863 cf

Subcatchment4.3S: TD-3 Runoff Area=1,105 sf 97.29% Impervious Runoff Depth=9.31"
Tc=6.0 min CN=97 Runoff=0.2 cfs 857 cf

Subcatchment4.4S: TD-4 Runoff Area=1,104 sf 97.46% Impervious Runoff Depth=9.31"
Tc=6.0 min CN=97 Runoff=0.2 cfs 856 cf

Subcatchment4.5S: TD-5 Runoff Area=1,082 sf 98.06% Impervious Runoff Depth=9.43"
Tc=6.0 min CN=98 Runoff=0.2 cfs 850 cf

Subcatchment4.6S: TD-6 Runoff Area=1,056 sf 99.24% Impervious Runoff Depth=9.43"
Tc=6.0 min CN=98 Runoff=0.2 cfs 830 cf

Subcatchment5.1S: TD-1A Runoff Area=1,389 sf 84.59% Impervious Runoff Depth=8.94"
Tc=6.0 min CN=94 Runoff=0.3 cfs 1,035 cf

Subcatchment5S: TD-1B Runoff Area=4,462 sf 42.78% Impervious Runoff Depth=7.71"
Tc=6.0 min CN=84 Runoff=0.9 cfs 2,866 cf

Subcatchment6.1S: East driveway Runoff Area=12,275 sf 52.50% Impervious Runoff Depth=8.08"
Tc=6.0 min CN=87 Runoff=2.5 cfs 8,268 cf

Subcatchment6S: Bypass Towards Runoff Area=51,539 sf 0.21% Impervious Runoff Depth=6.44"
Flow Length=125' Tc=14.0 min CN=74 Runoff=6.9 cfs 27,672 cf

Subcatchment7S: To Street Runoff Area=5,843 sf 18.07% Impervious Runoff Depth=6.95"
Tc=6.0 min CN=78 Runoff=1.1 cfs 3,385 cf

Pond 1P: Inf Syst-1 Peak Elev=10.70' Storage=17,296 cf Inflow=12.4 cfs 44,458 cf
Discarded=0.1 cfs 15,169 cf Primary=5.2 cfs 29,289 cf Outflow=5.3 cfs 44,458 cf

Pond 3P: Rain garden Peak Elev=6.48' Storage=245 cf Inflow=2.5 cfs 8,268 cf
Discarded=0.0 cfs 506 cf Primary=2.5 cfs 7,762 cf Outflow=2.5 cfs 8,268 cf

Pond 4P: Inf Syst-2 Peak Elev=9.54' Storage=134 cf Inflow=0.2 cfs 863 cf
Discarded=0.0 cfs 160 cf Primary=0.2 cfs 689 cf Outflow=0.2 cfs 849 cf

Pond 5P: Inf Syst-3 Peak Elev=9.68' Storage=140 cf Inflow=0.2 cfs 857 cf
Discarded=0.0 cfs 160 cf Primary=0.2 cfs 678 cf Outflow=0.2 cfs 838 cf

Pond 6P: Inf Syst-4 Peak Elev=9.68' Storage=140 cf Inflow=0.2 cfs 856 cf
Discarded=0.0 cfs 160 cf Primary=0.2 cfs 677 cf Outflow=0.2 cfs 837 cf

Pond 7P: Inf Syst-5 Peak Elev=9.30' Storage=122 cf Inflow=0.2 cfs 850 cf
Discarded=0.0 cfs 161 cf Primary=0.2 cfs 688 cf Outflow=0.2 cfs 849 cf

Pond 8P: Inf Syst-6 Peak Elev=9.32' Storage=123 cf Inflow=0.2 cfs 830 cf
Discarded=0.0 cfs 161 cf Primary=0.2 cfs 668 cf Outflow=0.2 cfs 829 cf

Pond 9P: Inf Syst-7 Peak Elev=8.58' Storage=2,968 cf Inflow=5.1 cfs 17,290 cf
Discarded=0.0 cfs 1,591 cf Primary=3.0 cfs 15,699 cf Outflow=3.0 cfs 17,290 cf

Link 1L: Towards Wetlands Inflow=17.0 cfs 83,287 cf
Primary=17.0 cfs 83,287 cf

Link 2L: Towards Street Inflow=1.1 cfs 3,385 cf
Primary=1.1 cfs 3,385 cf

Link 100L: Total Flows Inflow=17.8 cfs 86,673 cf
Primary=17.8 cfs 86,673 cf

Total Runoff Area = 158,686 sf Runoff Volume = 104,796 cf Average Runoff Depth = 7.92"
50.41% Pervious = 79,997 sf 49.59% Impervious = 78,689 sf

Summary for Subcatchment 1S: CB-1

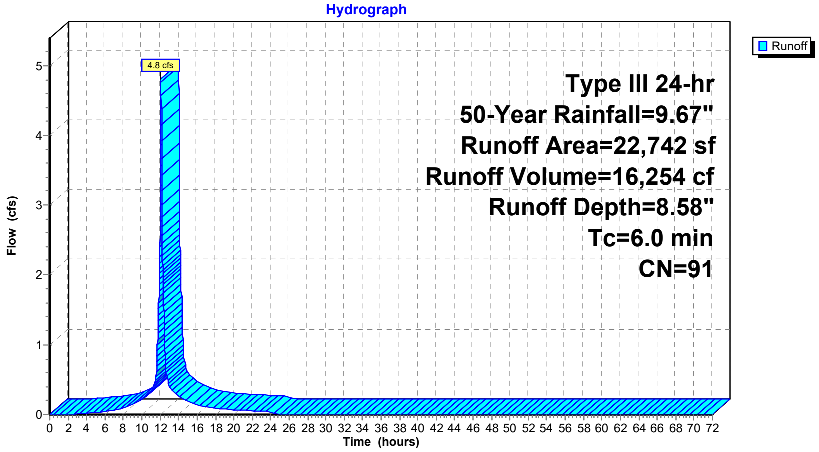
Runoff = 4.8 cfs @ 12.08 hrs, Volume= 16,254 cf, Depth= 8.58"
Routed to Pond 9P : Inf Syst-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
16,410	98	Paved parking, HSG C
6,332	74	>75% Grass cover, Good, HSG C
22,742	91	Weighted Average
6,332		27.84% Pervious Area
16,410		72.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 1S: CB-1



Summary for Subcatchment 2S: Building Roof

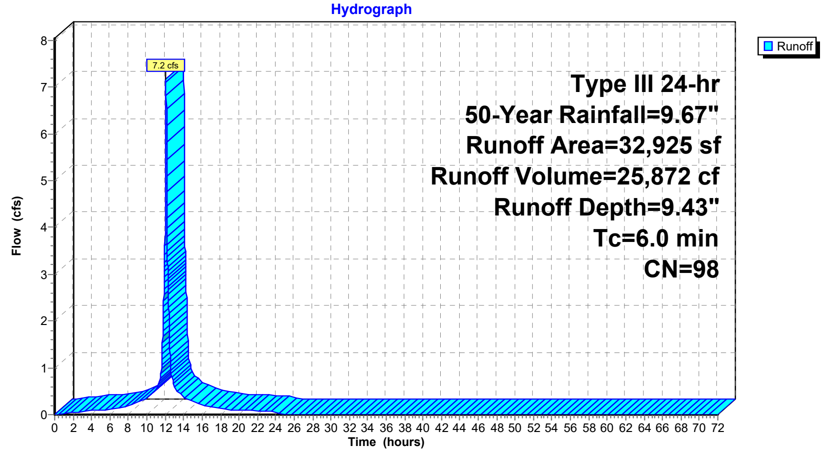
Runoff = 7.2 cfs @ 12.08 hrs, Volume= 25,872 cf, Depth= 9.43"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
32,925	98	Roofs, HSG C
32,925		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 2S: Building Roof



Summary for Subcatchment 3.1S: Backyard ADs

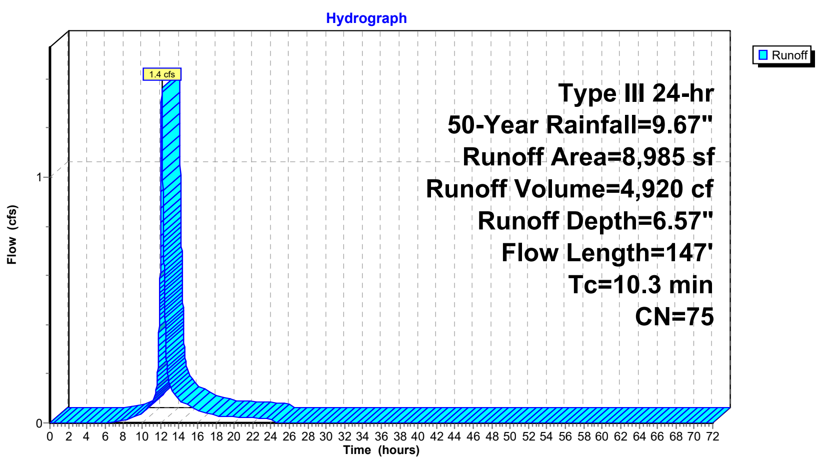
Runoff = 1.4 cfs @ 12.14 hrs, Volume= 4,920 cf, Depth= 6.57"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

	Area (sf)	CN	Description
	272	98	Unconnected pavement, HSG C
	8,302	74	>75% Grass cover, Good, HSG C
*	411	89	Gravel sidewalk, HSG C
	8,985	75	Weighted Average
	8,713		96.97% Pervious Area
	272		3.03% Impervious Area
	272		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	50	0.0142	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.23"
0.9	97	0.0154	1.86		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
10.3	147	Total			

Subcatchment 3.1S: Backyard ADs



Summary for Subcatchment 3S: Townhouse Roofs

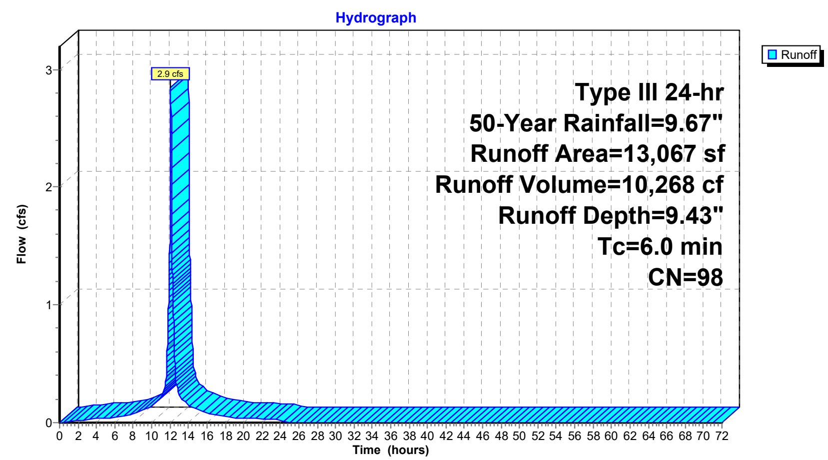
Runoff = 2.9 cfs @ 12.08 hrs, Volume= 10,268 cf, Depth= 9.43"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
13,067	98	Roofs, HSG C
13,067		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 3S: Townhouse Roofs



Summary for Subcatchment 4.2S: TD-2

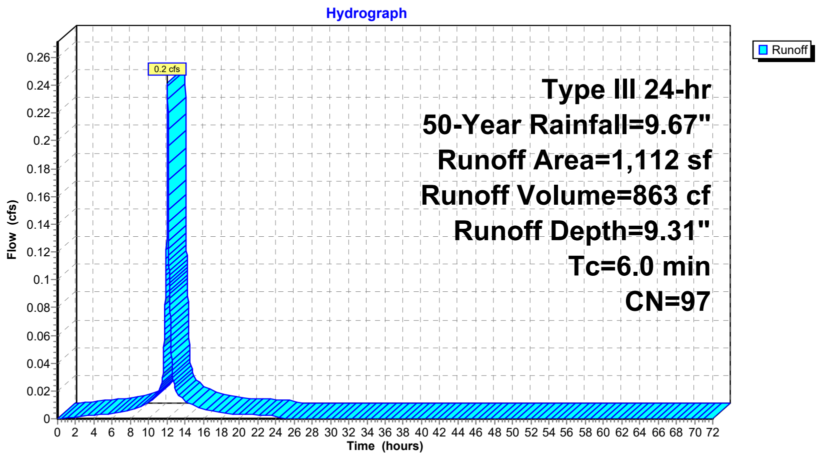
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 863 cf, Depth= 9.31"
Routed to Pond 4P : Inf Syst-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
1,064	98	Paved parking, HSG C
48	74	>75% Grass cover, Good, HSG C
1,112	97	Weighted Average
48		4.32% Pervious Area
1,064		95.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.2S: TD-2



Summary for Subcatchment 4.3S: TD-3

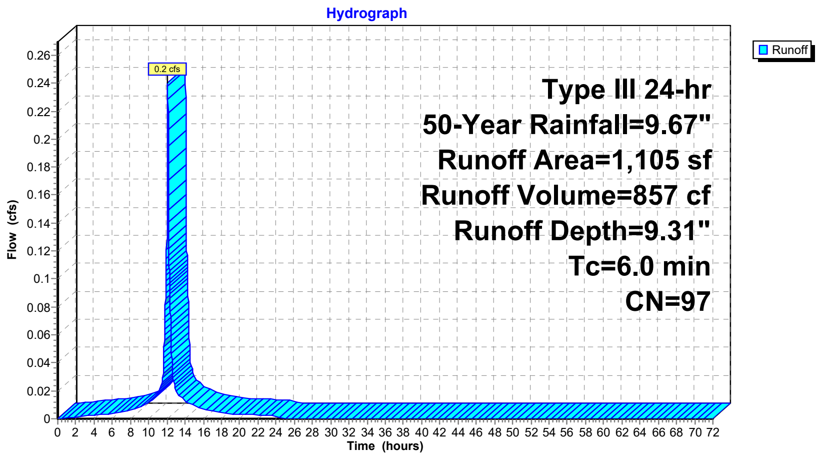
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 857 cf, Depth= 9.31"
Routed to Pond 5P : Inf Syst-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
1,075	98	Paved parking, HSG C
30	74	>75% Grass cover, Good, HSG C
1,105	97	Weighted Average
30		2.71% Pervious Area
1,075		97.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.3S: TD-3



Summary for Subcatchment 4.4S: TD-4

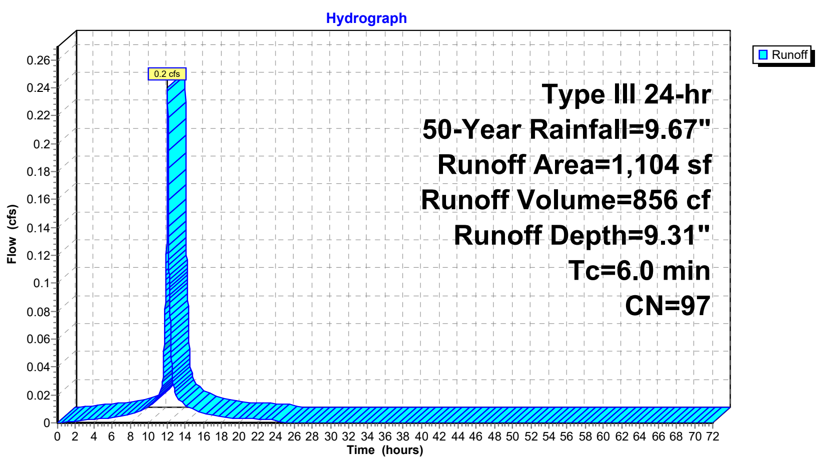
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 856 cf, Depth= 9.31"
Routed to Pond 6P : Inf Syst-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
1,076	98	Paved parking, HSG C
28	74	>75% Grass cover, Good, HSG C
1,104	97	Weighted Average
28		2.54% Pervious Area
1,076		97.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.4S: TD-4



Summary for Subcatchment 4.5S: TD-5

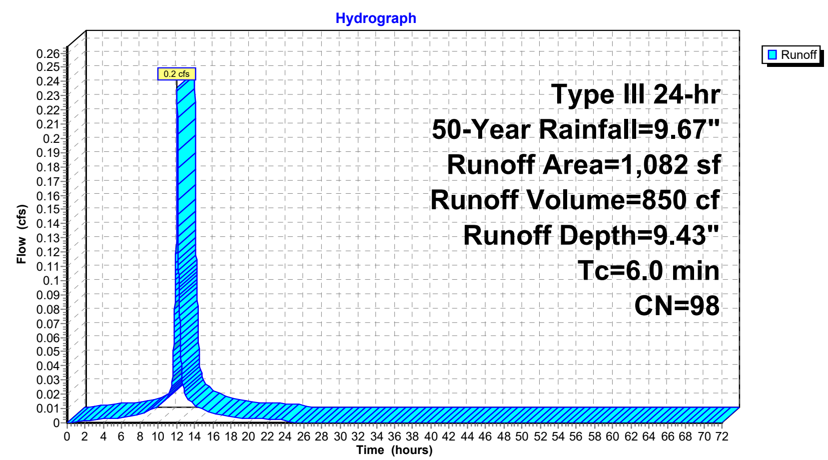
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 850 cf, Depth= 9.43"
Routed to Pond 7P : Inf Syst-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
1,061	98	Paved parking, HSG C
21	74	>75% Grass cover, Good, HSG C
1,082	98	Weighted Average
21		1.94% Pervious Area
1,061		98.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.5S: TD-5



Summary for Subcatchment 4.6S: TD-6

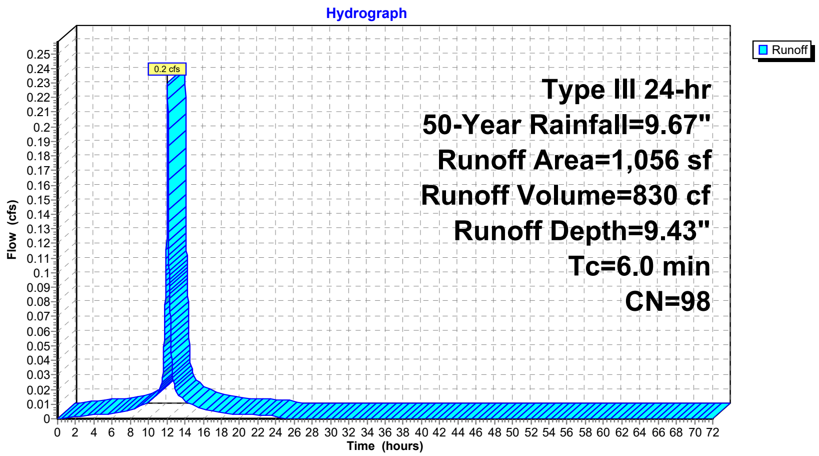
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 830 cf, Depth= 9.43"
Routed to Pond 8P : Inf Syst-6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
1,048	98	Paved parking, HSG C
8	74	>75% Grass cover, Good, HSG C
1,056	98	Weighted Average
8		0.76% Pervious Area
1,048		99.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.6S: TD-6



Summary for Subcatchment 5.1S: TD-1A

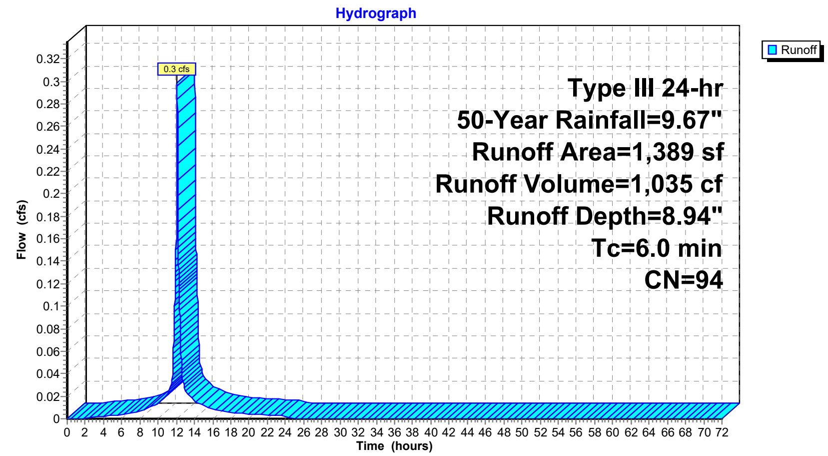
Runoff = 0.3 cfs @ 12.08 hrs, Volume= 1,035 cf, Depth= 8.94"
Routed to Pond 9P : Inf Syst-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
1,175	98	Paved parking, HSG C
214	74	>75% Grass cover, Good, HSG C
1,389	94	Weighted Average
214		15.41% Pervious Area
1,175		84.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 5.1S: TD-1A



Summary for Subcatchment 5S: TD-1B

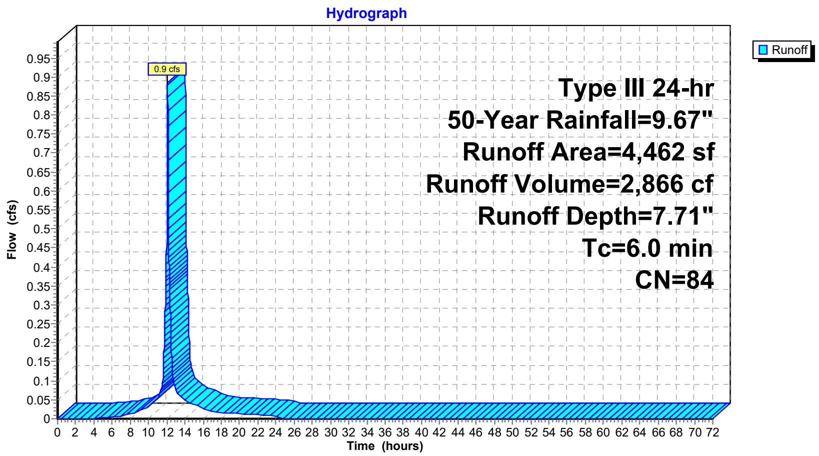
Runoff = 0.9 cfs @ 12.08 hrs, Volume= 2,866 cf, Depth= 7.71"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
1,909	98	Paved parking, HSG C
2,553	74	>75% Grass cover, Good, HSG C
4,462	84	Weighted Average
2,553		57.22% Pervious Area
1,909		42.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 5S: TD-1B



Summary for Subcatchment 6.1S: East driveway

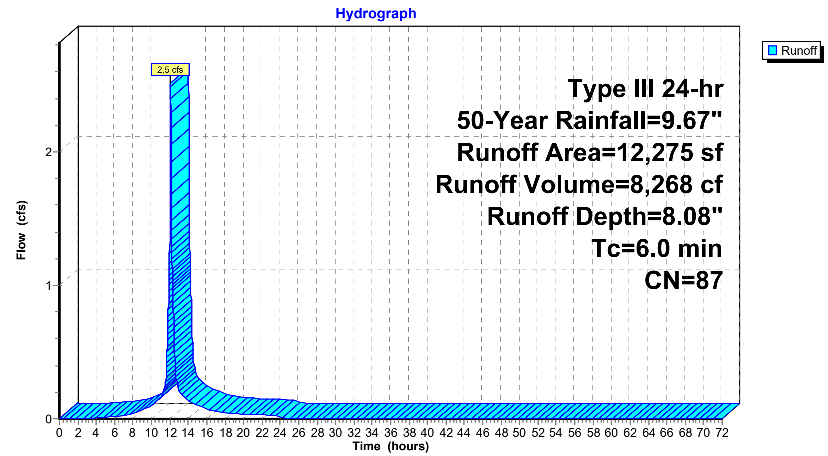
Runoff = 2.5 cfs @ 12.08 hrs, Volume= 8,268 cf, Depth= 8.08"
Routed to Pond 3P : Rain garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
5,611	74	>75% Grass cover, Good, HSG C
6,444	98	Paved roads w/curbs & sewers, HSG C
220	89	Gravel roads, HSG C
12,275	87	Weighted Average
5,831		47.50% Pervious Area
6,444		52.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 6.1S: East driveway



Summary for Subcatchment 6S: Bypass Towards Wetlands

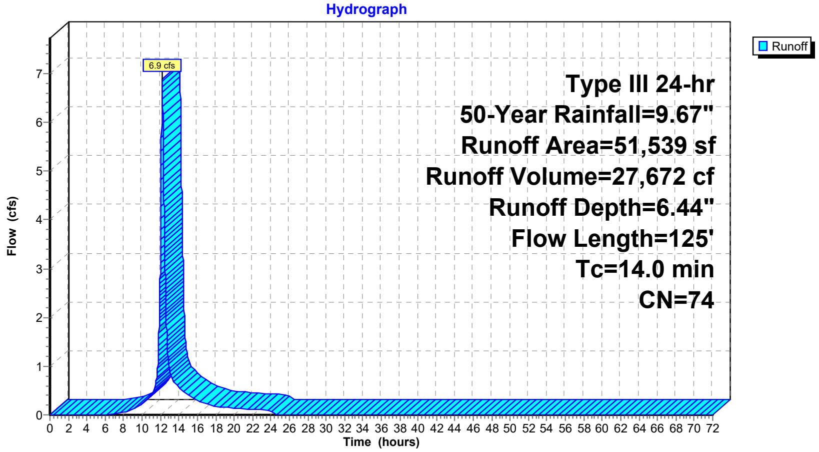
Runoff = 6.9 cfs @ 12.19 hrs, Volume= 27,672 cf, Depth= 6.44"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
4,985	70	Woods, Good, HSG C
46,447	74	>75% Grass cover, Good, HSG C
107	98	Roofs, HSG C
51,539	74	Weighted Average
51,432		99.79% Pervious Area
107		0.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	50	0.0220	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
2.2	75	0.0133	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	125	Total			

Subcatchment 6S: Bypass Towards Wetlands



Summary for Subcatchment 7S: To Street

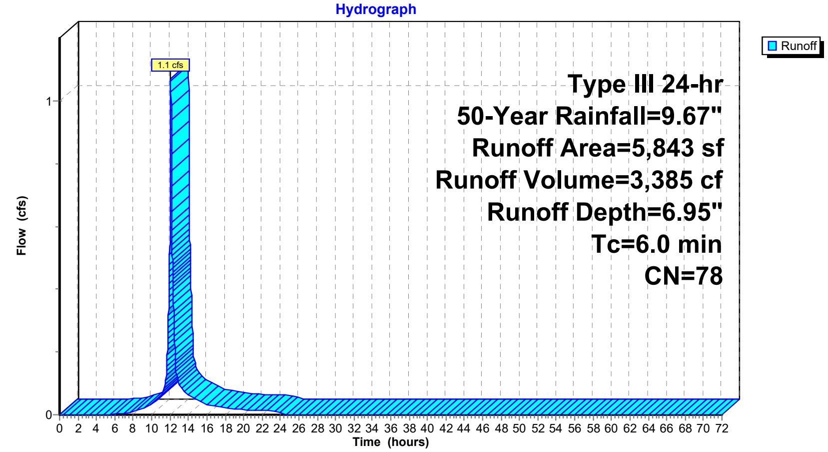
Runoff = 1.1 cfs @ 12.09 hrs, Volume= 3,385 cf, Depth= 6.95"
Routed to Link 2L : Towards Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
1,056	98	Paved parking, HSG C
4,787	74	>75% Grass cover, Good, HSG C
5,843	78	Weighted Average
4,787		81.93% Pervious Area
1,056		18.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 7S: To Street



Summary for Pond 1P: Inf Syst-1

Inflow Area = 60,436 sf, 85.36% Impervious, Inflow Depth = 8.83" for 50-Year event
Inflow = 12.4 cfs @ 12.09 hrs, Volume= 44,458 cf
Outflow = 5.3 cfs @ 12.30 hrs, Volume= 44,458 cf, Atten= 57%, Lag= 12.5 min
Discarded = 0.1 cfs @ 3.50 hrs, Volume= 15,169 cf
Primary = 5.2 cfs @ 12.30 hrs, Volume= 29,289 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 10.70' @ 12.30 hrs Surf.Area= 7,459 sf Storage= 17,296 cf

Plug-Flow detention time= 312.6 min calculated for 44,458 cf (100% of inflow)
Center-of-Mass det. time= 312.5 min (1,063.8 - 751.2)

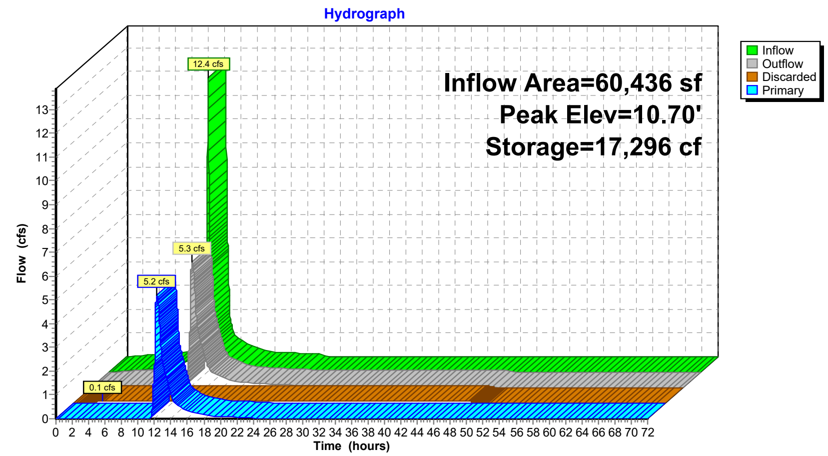
Volume	Invert	Avail.Storage	Storage Description
#1	8.00'	19,245 cf	**6.89'W x 14.06'L x 3.00'H StormTrap ST-1 Units (Irregular Shape)** x 77 22,378 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	8.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	8.00'	**15.0" Round Culvert** L= 26.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 8.00' / 7.13' S= 0.0335 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#3	Device 2	9.22'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	10.05'	**20.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 2	10.79'	**3.7' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.1 cfs @ 3.50 hrs HW=8.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=5.2 cfs @ 12.30 hrs HW=10.70' (Free Discharge)
└─**2=Culvert** (Passes 5.2 cfs of 8.5 cfs potential flow)
  ├─**3=Orifice/Grate** (Orifice Controls 3.4 cfs @ 5.51 fps)
  ├─**4=Orifice/Grate** (Orifice Controls 1.8 cfs @ 3.32 fps)
  └─**5=Sharp-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 1P: Inf Syst-1



Summary for Pond 3P: Rain garden

Inflow Area = 12,275 sf, 52.50% Impervious, Inflow Depth = 8.08" for 50-Year event
Inflow = 2.5 cfs @ 12.08 hrs, Volume= 8,268 cf
Outflow = 2.5 cfs @ 12.09 hrs, Volume= 8,268 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.0 cfs @ 12.09 hrs, Volume= 506 cf
Primary = 2.5 cfs @ 12.09 hrs, Volume= 7,762 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 6.48' @ 12.09 hrs Surf.Area= 450 sf Storage= 245 cf

Plug-Flow detention time= 35.3 min calculated for 8,268 cf (100% of inflow)
Center-of-Mass det. time= 35.2 min (814.3 - 779.1)

Volume	Invert	Avail.Storage	Storage Description
#1	5.60'	253 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

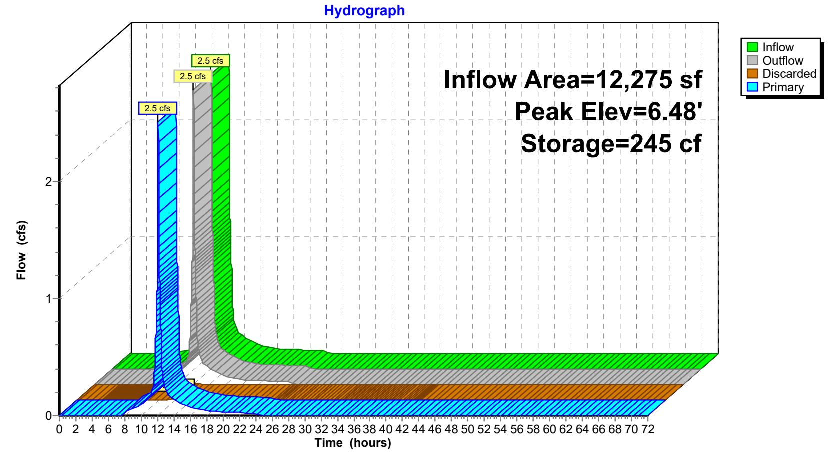
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.60	125	46.0	0	0	125
6.00	276	66.0	78	78	305
6.30	350	73.0	94	172	385
6.50	460	87.0	81	253	564

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.60'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	6.35'	**22.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.0 cfs @ 12.09 hrs HW=6.48' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=2.5 cfs @ 12.09 hrs HW=6.48' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 2.5 cfs @ 0.85 fps)

Pond 3P: Rain garden



Summary for Pond 4P: Inf Syst-2

Inflow Area = 1,112 sf, 95.68% Impervious, Inflow Depth = 9.31" for 50-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 863 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 849 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.70 hrs, Volume= 160 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 689 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.54' @ 12.09 hrs Surf.Area= 101 sf Storage= 134 cf

Plug-Flow detention time= 326.9 min calculated for 849 cf (98% of inflow)
Center-of-Mass det. time= 316.9 min (1,061.1 - 744.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A**
			274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1
			Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf
			Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf
			10 Chambers in 2 Rows
		141 cf	Total Available Storage

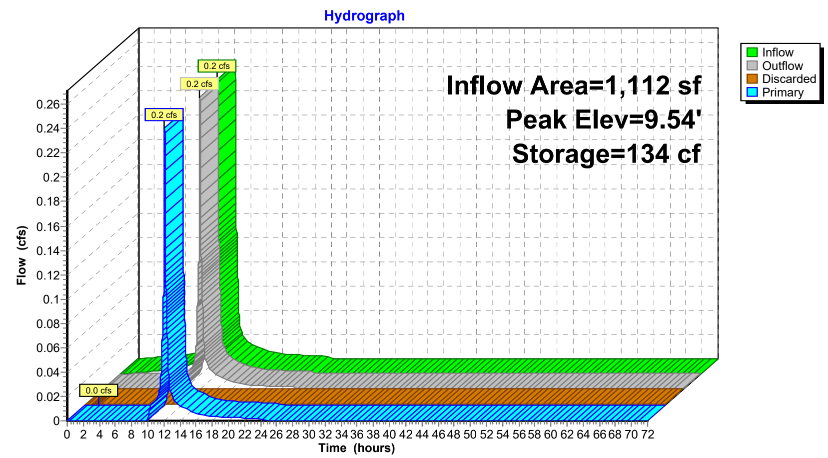
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.23'	**6.0" Round Culvert**
			L= 33.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 9.23' / 8.72' S= 0.0155 '/' Cc= 0.900
			n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 1.70 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.54' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.2 cfs @ 1.89 fps)

Pond 4P: Inf Syst-2



Summary for Pond 5P: Inf Syst-3

Inflow Area = 1,105 sf, 97.29% Impervious, Inflow Depth = 9.31" for 50-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 857 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 838 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.73 hrs, Volume= 160 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 678 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.68' @ 12.09 hrs Surf.Area= 101 sf Storage= 140 cf

Plug-Flow detention time= 335.8 min calculated for 838 cf (98% of inflow)
Center-of-Mass det. time= 321.7 min (1,066.0 - 744.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

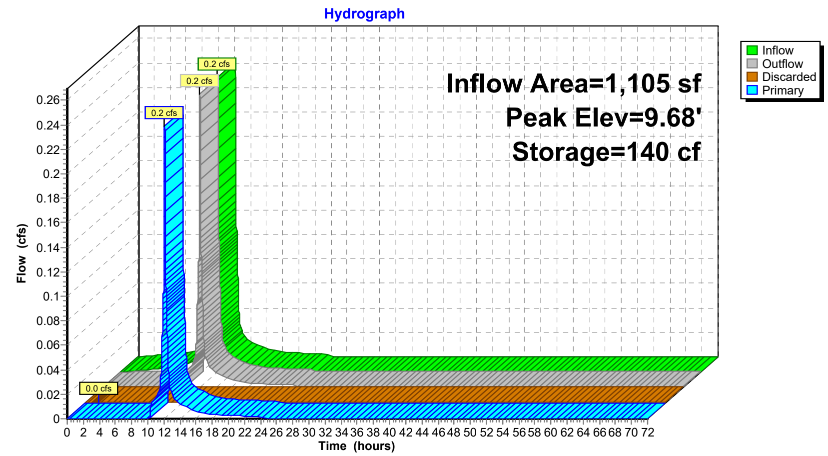
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.37'	**6.0" Round Culvert** L= 33.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.37' / 8.73' S= 0.0194 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 1.73 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.68' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.2 cfs @ 1.89 fps)

Pond 5P: Inf Syst-3



Summary for Pond 6P: Inf Syst-4

Inflow Area = 1,104 sf, 97.46% Impervious, Inflow Depth = 9.31" for 50-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 856 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 837 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.73 hrs, Volume= 160 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 677 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.68' @ 12.09 hrs Surf.Area= 101 sf Storage= 140 cf

Plug-Flow detention time= 336.1 min calculated for 837 cf (98% of inflow)
Center-of-Mass det. time= 322.0 min (1,066.2 - 744.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A**
			274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1
			Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf
			Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf
			10 Chambers in 2 Rows
		141 cf	Total Available Storage

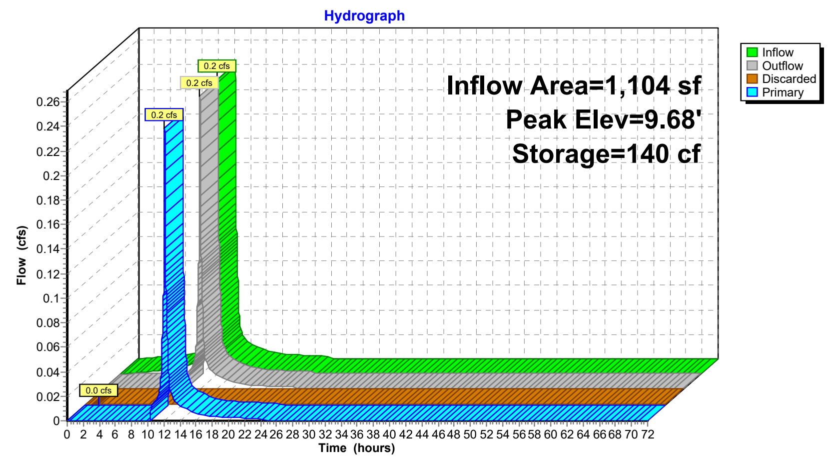
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.37'	**6.0" Round Culvert**
			L= 51.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 9.37' / 8.10' S= 0.0249 '/' Cc= 0.900
			n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 1.73 hrs HW=7.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.68' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.2 cfs @ 1.89 fps)

Pond 6P: Inf Syst-4



Summary for Pond 7P: Inf Syst-5

Inflow Area = 1,082 sf, 98.06% Impervious, Inflow Depth = 9.43" for 50-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 850 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 849 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.27 hrs, Volume= 161 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 688 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.30' @ 12.09 hrs Surf.Area= 101 sf Storage= 122 cf

Plug-Flow detention time= 318.0 min calculated for 849 cf (100% of inflow)
Center-of-Mass det. time= 317.6 min (1,056.6 - 739.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A** 241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1 Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf 10 Chambers in 2 Rows
		125 cf	Total Available Storage

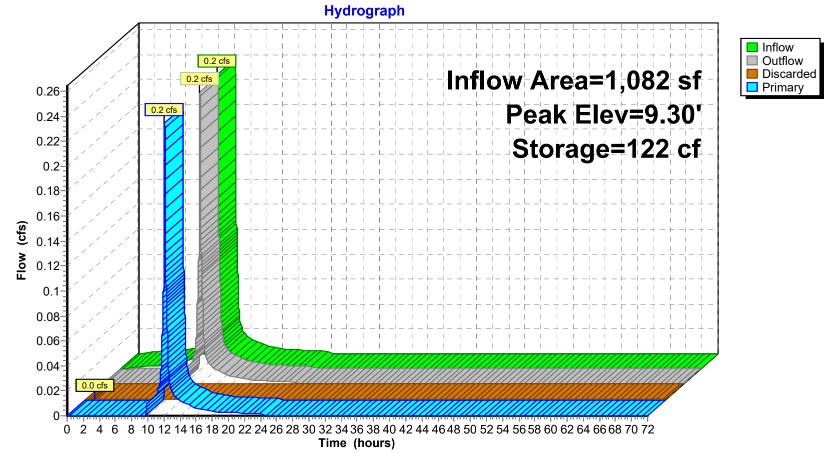
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**6.0" Round Culvert** L= 48.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.00' / 8.35' S= 0.0135 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 1.27 hrs HW=7.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.30' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.2 cfs @ 1.88 fps)

Pond 7P: Inf Syst-5



Summary for Pond 8P: Inf Syst-6

Inflow Area = 1,056 sf, 99.24% Impervious, Inflow Depth = 9.43" for 50-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 830 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 829 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.30 hrs, Volume= 161 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 668 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.32' @ 12.09 hrs Surf.Area= 101 sf Storage= 123 cf

Plug-Flow detention time= 325.6 min calculated for 829 cf (100% of inflow)
Center-of-Mass det. time= 325.0 min (1,064.0 - 739.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A** 241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1 Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf 10 Chambers in 2 Rows
		125 cf	Total Available Storage

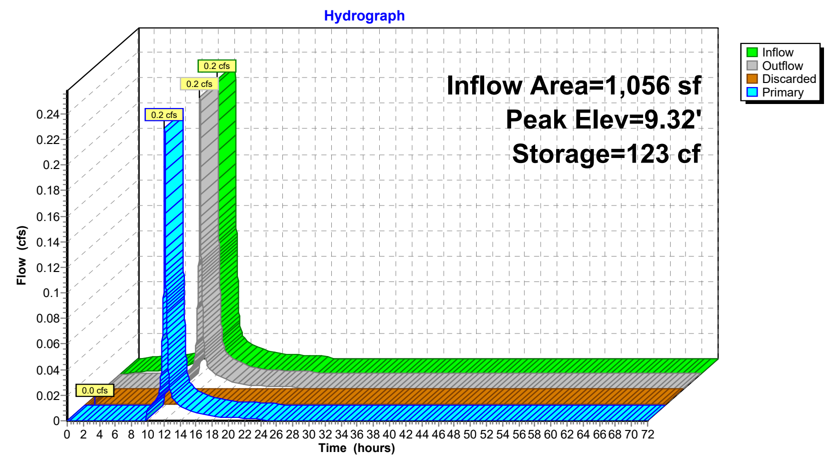
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**8.0" Round Culvert** L= 46.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.00' / 8.77' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 1.30 hrs HW=7.03' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.32' (Free Discharge)
2=Culvert (Barrel Controls 0.2 cfs @ 2.02 fps)

Pond 8P: Inf Syst-6



Summary for Pond 9P: Inf Syst-7

Inflow Area = 24,131 sf, 72.87% Impervious, Inflow Depth = 8.60" for 50-Year event
Inflow = 5.1 cfs @ 12.08 hrs, Volume= 17,290 cf
Outflow = 3.0 cfs @ 12.19 hrs, Volume= 17,290 cf, Atten= 41%, Lag= 6.3 min
Discarded = 0.0 cfs @ 4.01 hrs, Volume= 1,591 cf
Primary = 3.0 cfs @ 12.19 hrs, Volume= 15,699 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 8.58' @ 12.19 hrs Surf.Area= 2,422 sf Storage= 2,968 cf

Plug-Flow detention time= 48.3 min calculated for 17,290 cf (100% of inflow)
Center-of-Mass det. time= 48.2 min (815.1 - 766.9)

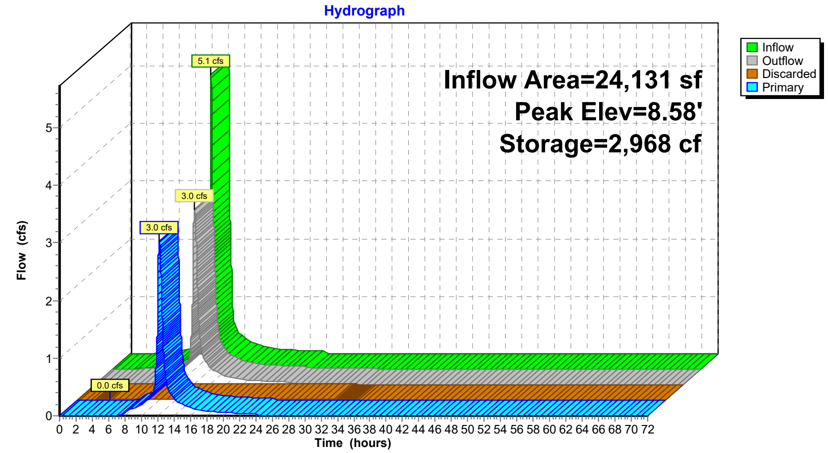
Volume	Invert	Avail.Storage	Storage Description
#1	7.15'	3,645 cf	**6.89'W x 14.06'L x 1.75'H StormTrap ST-1 Units (Irregular Shape)** x 25 4,238 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.15'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	7.15'	**12.0" Round Culvert** L= 4.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.15' / 7.13' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	7.35'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 4.01 hrs HW=7.17' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=3.0 cfs @ 12.19 hrs HW=8.58' (Free Discharge)
└─**2=Culvert** (Passes 3.0 cfs of 3.3 cfs potential flow)
└─**3=Orifice/Grate** (Orifice Controls 3.0 cfs @ 4.95 fps)

Pond 9P: Inf Syst-7

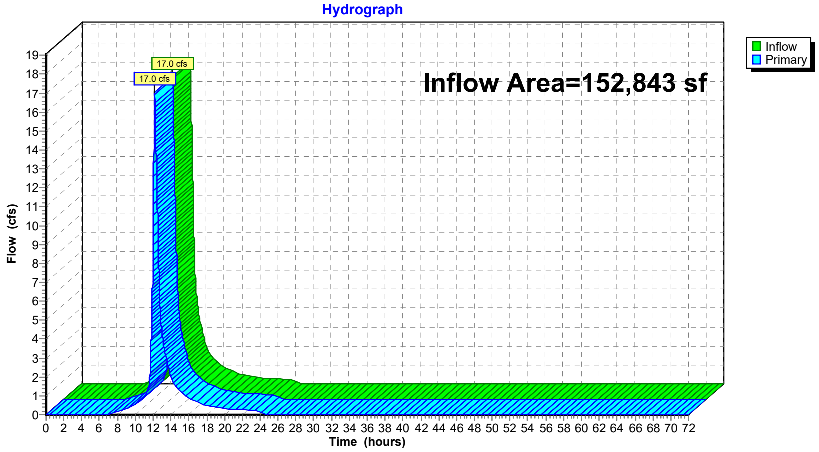


Summary for Link 1L: Towards Wetlands

Inflow Area = 152,843 sf, 50.79% Impervious, Inflow Depth = 6.54" for 50-Year event
Inflow = 17.0 cfs @ 12.18 hrs, Volume= 83,287 cf
Primary = 17.0 cfs @ 12.18 hrs, Volume= 83,287 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 1L: Towards Wetlands

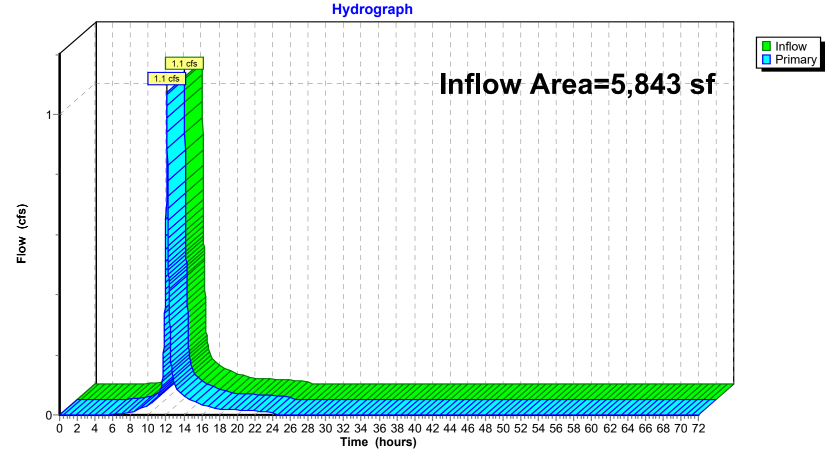


Summary for Link 2L: Towards Street

Inflow Area = 5,843 sf, 18.07% Impervious, Inflow Depth = 6.95" for 50-Year event
Inflow = 1.1 cfs @ 12.09 hrs, Volume= 3,385 cf
Primary = 1.1 cfs @ 12.09 hrs, Volume= 3,385 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 2L: Towards Street

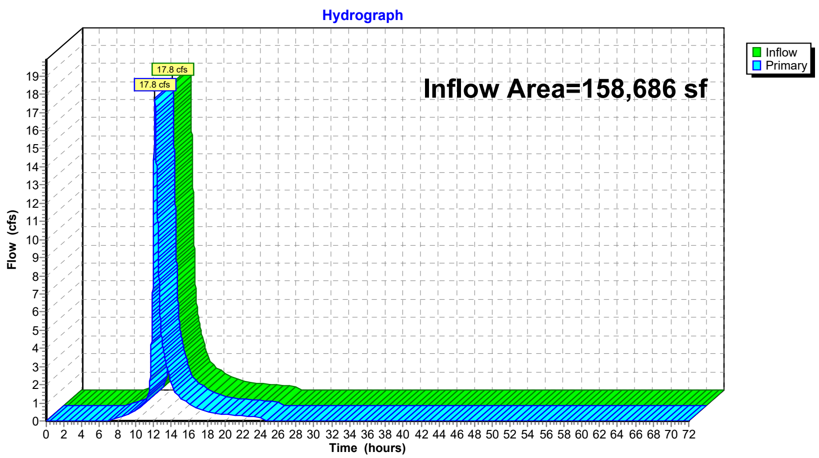


Summary for Link 100L: Total Flows

Inflow Area = 158,686 sf, 49.59% Impervious, Inflow Depth = 6.55" for 50-Year event
Inflow = 17.8 cfs @ 12.16 hrs, Volume= 86,673 cf
Primary = 17.8 cfs @ 12.16 hrs, Volume= 86,673 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 100L: Total Flows



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: CB-1 Runoff Area=22,742 sf 72.16% Impervious Runoff Depth=10.39"
Tc=6.0 min CN=91 Runoff=5.8 cfs 19,696 cf

Subcatchment2S: Building Roof Runoff Area=32,925 sf 100.00% Impervious Runoff Depth=11.26"
Tc=6.0 min CN=98 Runoff=8.5 cfs 30,891 cf

Subcatchment3.1S: Backyard ADs Runoff Area=8,985 sf 3.03% Impervious Runoff Depth=8.28"
Flow Length=147' Tc=10.3 min CN=75 Runoff=1.7 cfs 6,203 cf

Subcatchment3S: Townhouse Roofs Runoff Area=13,067 sf 100.00% Impervious Runoff Depth=11.26"
Tc=6.0 min CN=98 Runoff=3.4 cfs 12,260 cf

Subcatchment4.2S: TD-2 Runoff Area=1,112 sf 95.68% Impervious Runoff Depth=11.14"
Tc=6.0 min CN=97 Runoff=0.3 cfs 1,032 cf

Subcatchment4.3S: TD-3 Runoff Area=1,105 sf 97.29% Impervious Runoff Depth=11.14"
Tc=6.0 min CN=97 Runoff=0.3 cfs 1,026 cf

Subcatchment4.4S: TD-4 Runoff Area=1,104 sf 97.46% Impervious Runoff Depth=11.14"
Tc=6.0 min CN=97 Runoff=0.3 cfs 1,025 cf

Subcatchment4.5S: TD-5 Runoff Area=1,082 sf 98.06% Impervious Runoff Depth=11.26"
Tc=6.0 min CN=98 Runoff=0.3 cfs 1,015 cf

Subcatchment4.6S: TD-6 Runoff Area=1,056 sf 99.24% Impervious Runoff Depth=11.26"
Tc=6.0 min CN=98 Runoff=0.3 cfs 991 cf

Subcatchment5.1S: TD-1A Runoff Area=1,389 sf 84.59% Impervious Runoff Depth=10.77"
Tc=6.0 min CN=94 Runoff=0.4 cfs 1,246 cf

Subcatchment5S: TD-1B Runoff Area=4,462 sf 42.78% Impervious Runoff Depth=9.49"
Tc=6.0 min CN=84 Runoff=1.1 cfs 3,530 cf

Subcatchment6.1S: East driveway Runoff Area=12,275 sf 52.50% Impervious Runoff Depth=9.88"
Tc=6.0 min CN=87 Runoff=3.0 cfs 10,109 cf

Subcatchment6S: Bypass Towards Runoff Area=51,539 sf 0.21% Impervious Runoff Depth=8.15"
Flow Length=125' Tc=14.0 min CN=74 Runoff=8.7 cfs 34,988 cf

Subcatchment7S: To Street Runoff Area=5,843 sf 18.07% Impervious Runoff Depth=8.69"
Tc=6.0 min CN=78 Runoff=1.3 cfs 4,233 cf

Pond 1P: Inf Syst-1 Peak Elev=11.00' Storage=19,245 cf Inflow=14.8 cfs 53,582 cf
Discarded=0.1 cfs 15,354 cf Primary=7.3 cfs 38,228 cf Outflow=7.4 cfs 53,582 cf

Pond 3P: Rain garden Peak Elev=6.50' Storage=253 cf Inflow=3.0 cfs 10,109 cf
Discarded=0.0 cfs 518 cf Primary=3.0 cfs 9,592 cf Outflow=3.0 cfs 10,109 cf

Pond 4P: Inf Syst-2 Peak Elev=9.57' Storage=136 cf Inflow=0.3 cfs 1,032 cf
Discarded=0.0 cfs 161 cf Primary=0.3 cfs 858 cf Outflow=0.3 cfs 1,018 cf

Pond 5P: Inf Syst-3 Peak Elev=9.71' Storage=141 cf Inflow=0.3 cfs 1,026 cf
Discarded=0.0 cfs 161 cf Primary=0.3 cfs 846 cf Outflow=0.3 cfs 1,006 cf

Pond 6P: Inf Syst-4 Peak Elev=9.71' Storage=141 cf Inflow=0.3 cfs 1,025 cf
Discarded=0.0 cfs 161 cf Primary=0.3 cfs 845 cf Outflow=0.3 cfs 1,005 cf

Pond 7P: Inf Syst-5 Peak Elev=9.34' Storage=123 cf Inflow=0.3 cfs 1,015 cf
Discarded=0.0 cfs 161 cf Primary=0.3 cfs 853 cf Outflow=0.3 cfs 1,014 cf

Pond 8P: Inf Syst-6 Peak Elev=9.35' Storage=124 cf Inflow=0.3 cfs 991 cf
Discarded=0.0 cfs 161 cf Primary=0.3 cfs 828 cf Outflow=0.3 cfs 990 cf

Pond 9P: Inf Syst-7 Peak Elev=8.86' Storage=3,555 cf Inflow=6.1 cfs 20,942 cf
Discarded=0.0 cfs 1,621 cf Primary=3.4 cfs 19,322 cf Outflow=3.4 cfs 20,942 cf

Link 1L: Towards Wetlands Inflow=21.4 cfs 105,660 cf
Primary=21.4 cfs 105,660 cf

Link 2L: Towards Street Inflow=1.3 cfs 4,233 cf
Primary=1.3 cfs 4,233 cf

Link 100L: Total Flows Inflow=22.3 cfs 109,893 cf
Primary=22.3 cfs 109,893 cf

Total Runoff Area = 158,686 sf Runoff Volume = 128,244 cf Average Runoff Depth = 9.70"
50.41% Pervious = 79,997 sf 49.59% Impervious = 78,689 sf

Summary for Subcatchment 1S: CB-1

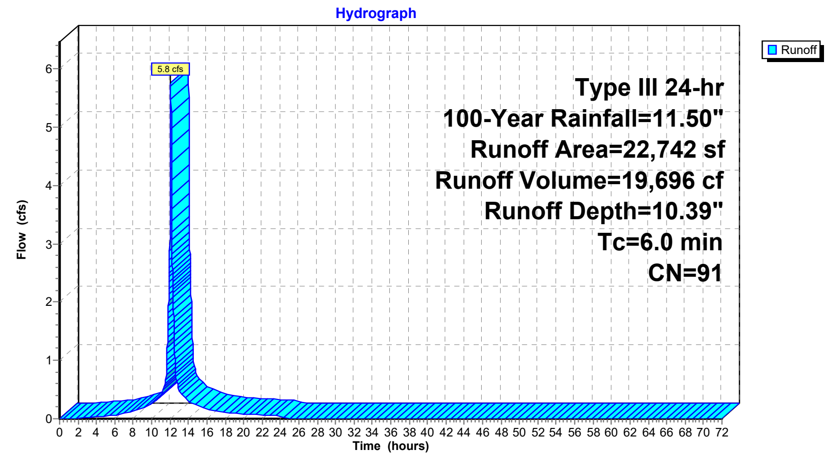
Runoff = 5.8 cfs @ 12.08 hrs, Volume= 19,696 cf, Depth=10.39"
Routed to Pond 9P : Inf Syst-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
16,410	98	Paved parking, HSG C
6,332	74	>75% Grass cover, Good, HSG C
22,742	91	Weighted Average
6,332		27.84% Pervious Area
16,410		72.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 1S: CB-1



Summary for Subcatchment 2S: Building Roof

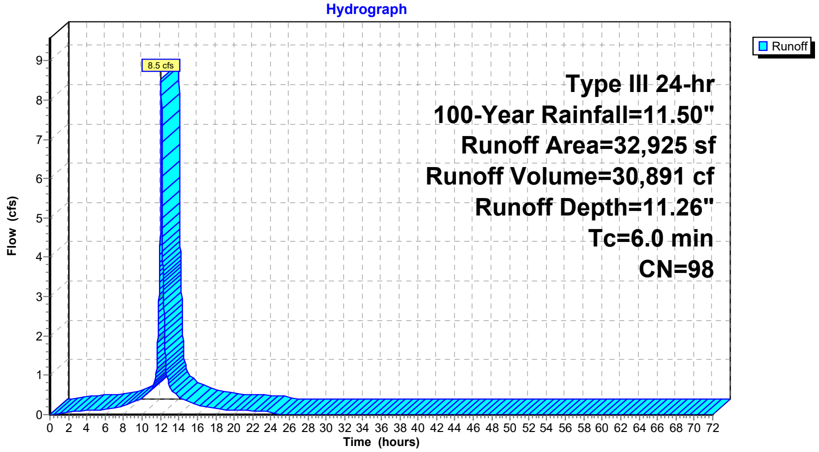
Runoff = 8.5 cfs @ 12.08 hrs, Volume= 30,891 cf, Depth=11.26"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
32,925	98	Roofs, HSG C
32,925		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 2S: Building Roof



Summary for Subcatchment 3.1S: Backyard ADs

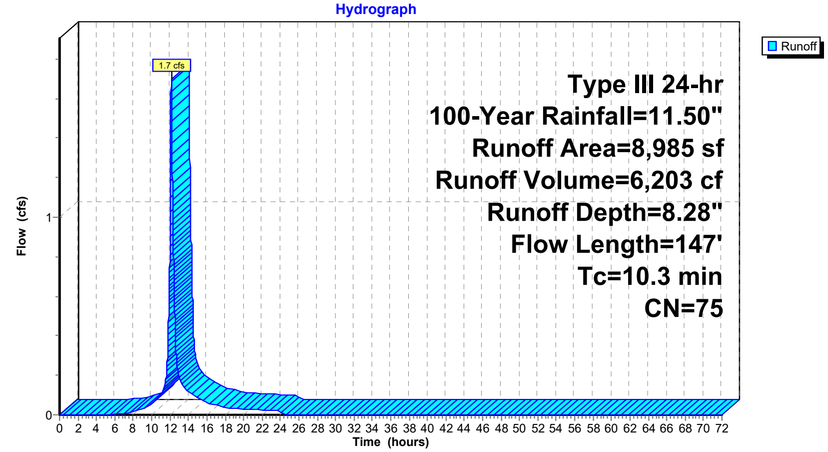
Runoff = 1.7 cfs @ 12.14 hrs, Volume= 6,203 cf, Depth= 8.28"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

	Area (sf)	CN	Description
	272	98	Unconnected pavement, HSG C
	8,302	74	>75% Grass cover, Good, HSG C
*	411	89	Gravel sidewalk, HSG C
	8,985	75	Weighted Average
	8,713		96.97% Pervious Area
	272		3.03% Impervious Area
	272		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	50	0.0142	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.23"
0.9	97	0.0154	1.86		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
10.3	147	Total			

Subcatchment 3.1S: Backyard ADs



Summary for Subcatchment 3S: Townhouse Roofs

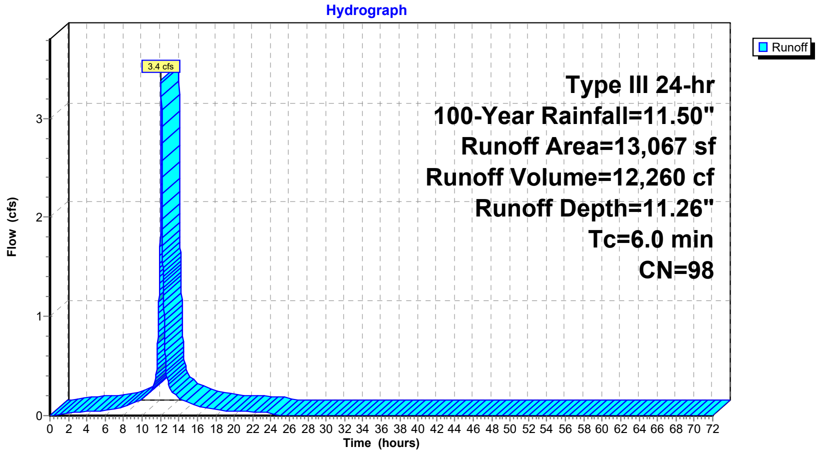
Runoff = 3.4 cfs @ 12.08 hrs, Volume= 12,260 cf, Depth=11.26"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
13,067	98	Roofs, HSG C
13,067		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 3S: Townhouse Roofs



Summary for Subcatchment 4.2S: TD-2

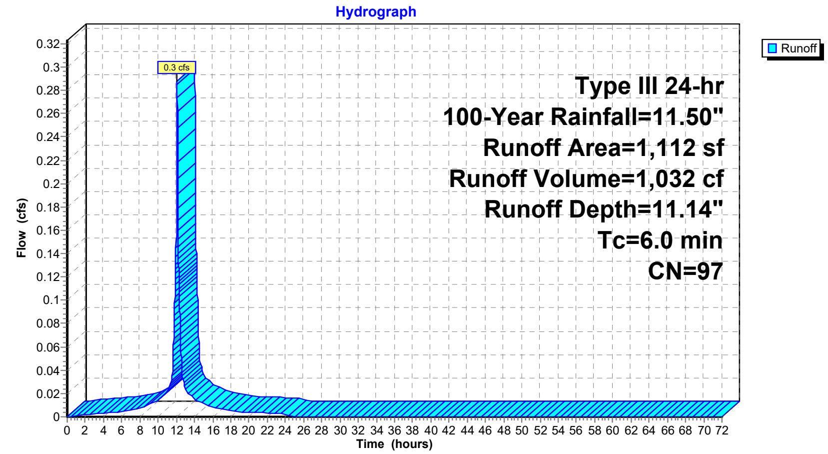
Runoff = 0.3 cfs @ 12.08 hrs, Volume= 1,032 cf, Depth=11.14"
Routed to Pond 4P : Inf Syst-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
1,064	98	Paved parking, HSG C
48	74	>75% Grass cover, Good, HSG C
1,112	97	Weighted Average
48		4.32% Pervious Area
1,064		95.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.2S: TD-2



Summary for Subcatchment 4.3S: TD-3

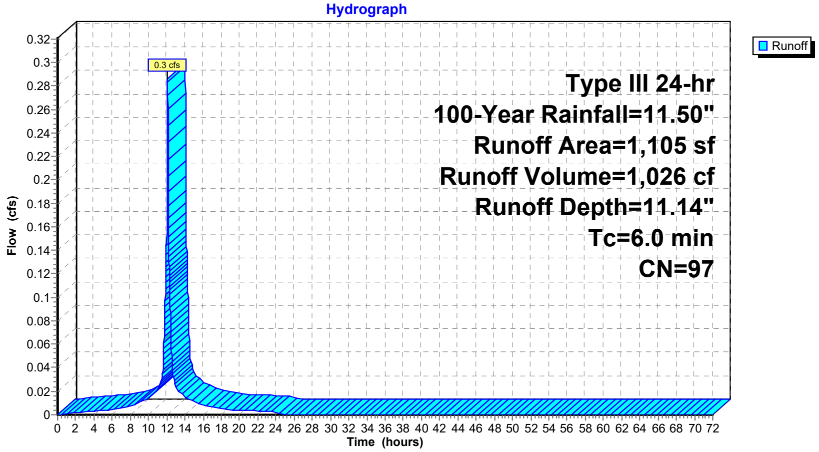
Runoff = 0.3 cfs @ 12.08 hrs, Volume= 1,026 cf, Depth=11.14"
Routed to Pond 5P : Inf Syst-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
1,075	98	Paved parking, HSG C
30	74	>75% Grass cover, Good, HSG C
1,105	97	Weighted Average
30		2.71% Pervious Area
1,075		97.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.3S: TD-3



Summary for Subcatchment 4.4S: TD-4

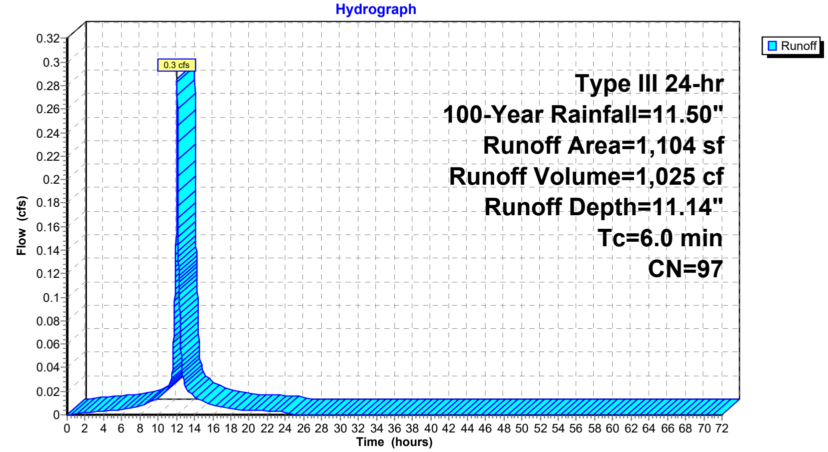
Runoff = 0.3 cfs @ 12.08 hrs, Volume= 1,025 cf, Depth=11.14"
Routed to Pond 6P : Inf Syst-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
1,076	98	Paved parking, HSG C
28	74	>75% Grass cover, Good, HSG C
1,104	97	Weighted Average
28		2.54% Pervious Area
1,076		97.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.4S: TD-4



Summary for Subcatchment 4.5S: TD-5

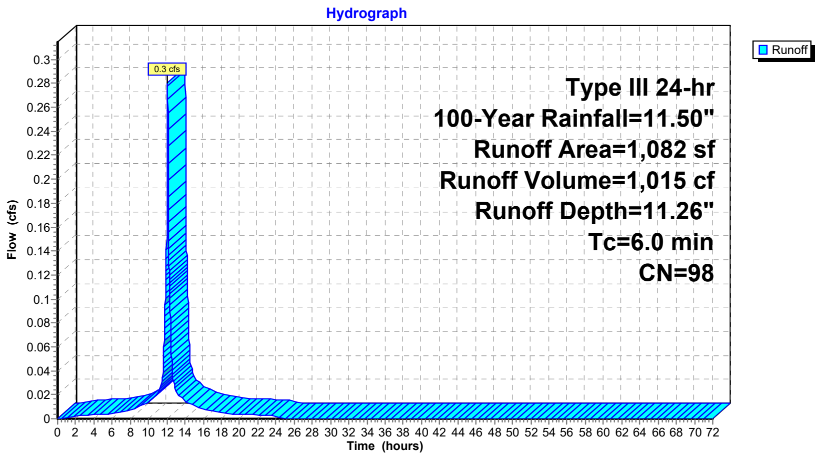
Runoff = 0.3 cfs @ 12.08 hrs, Volume= 1,015 cf, Depth=11.26"
Routed to Pond 7P : Inf Syst-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
1,061	98	Paved parking, HSG C
21	74	>75% Grass cover, Good, HSG C
1,082	98	Weighted Average
21		1.94% Pervious Area
1,061		98.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.5S: TD-5



Summary for Subcatchment 4.6S: TD-6

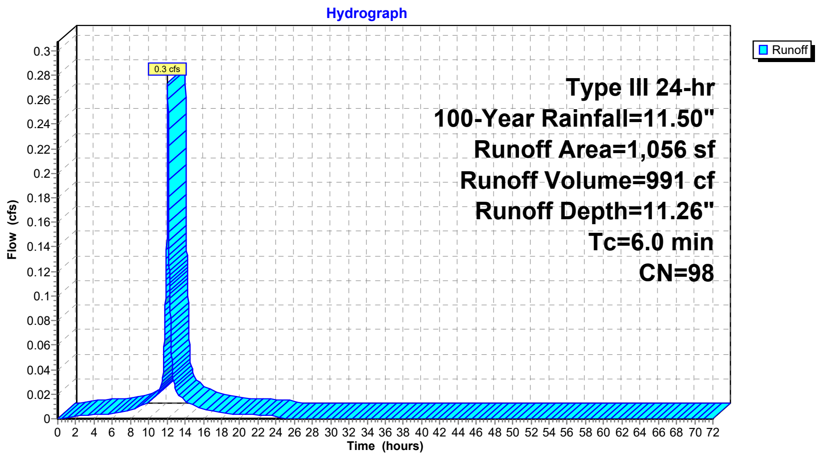
Runoff = 0.3 cfs @ 12.08 hrs, Volume= 991 cf, Depth=11.26"
Routed to Pond 8P : Inf Syst-6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
1,048	98	Paved parking, HSG C
8	74	>75% Grass cover, Good, HSG C
1,056	98	Weighted Average
8		0.76% Pervious Area
1,048		99.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.6S: TD-6



Summary for Subcatchment 5.1S: TD-1A

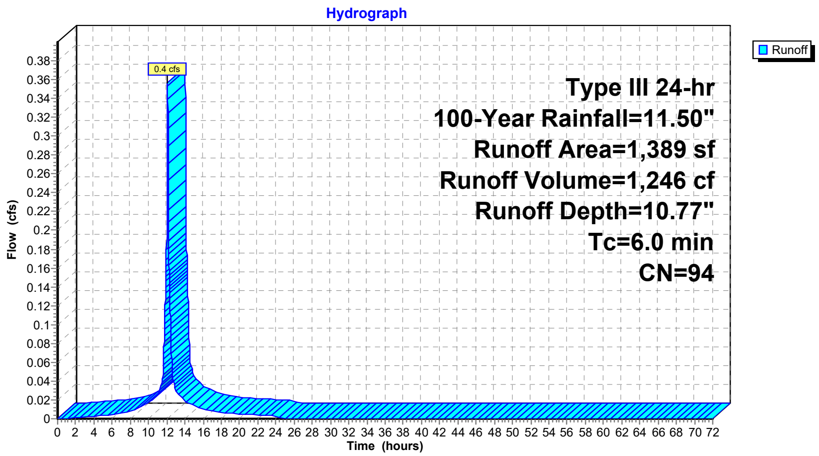
Runoff = 0.4 cfs @ 12.08 hrs, Volume= 1,246 cf, Depth=10.77"
Routed to Pond 9P : Inf Syst-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
1,175	98	Paved parking, HSG C
214	74	>75% Grass cover, Good, HSG C
1,389	94	Weighted Average
214		15.41% Pervious Area
1,175		84.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 5.1S: TD-1A



Summary for Subcatchment 5S: TD-1B

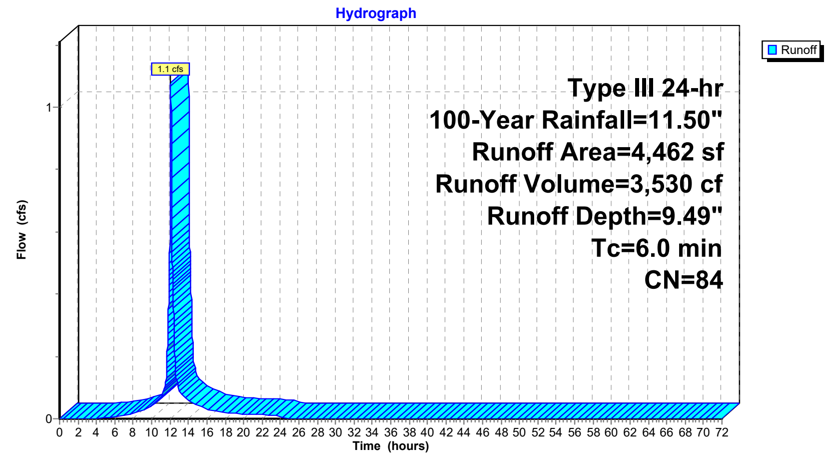
Runoff = 1.1 cfs @ 12.08 hrs, Volume= 3,530 cf, Depth= 9.49"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
1,909	98	Paved parking, HSG C
2,553	74	>75% Grass cover, Good, HSG C
4,462	84	Weighted Average
2,553		57.22% Pervious Area
1,909		42.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 5S: TD-1B



Summary for Subcatchment 6.1S: East driveway

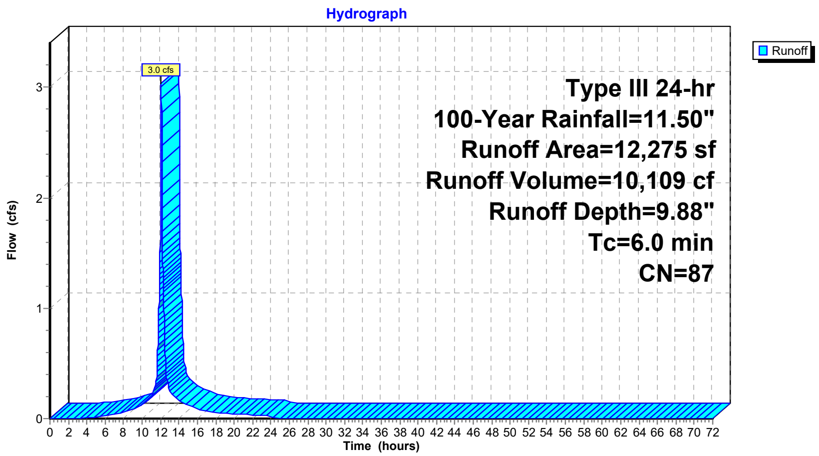
Runoff = 3.0 cfs @ 12.08 hrs, Volume= 10,109 cf, Depth= 9.88"
Routed to Pond 3P : Rain garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
5,611	74	>75% Grass cover, Good, HSG C
6,444	98	Paved roads w/curbs & sewers, HSG C
220	89	Gravel roads, HSG C
12,275	87	Weighted Average
5,831		47.50% Pervious Area
6,444		52.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 6.1S: East driveway



Summary for Subcatchment 6S: Bypass Towards Wetlands

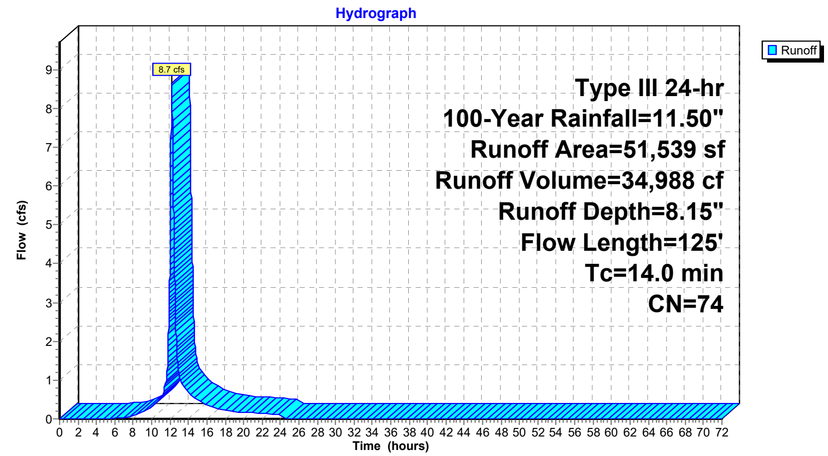
Runoff = 8.7 cfs @ 12.18 hrs, Volume= 34,988 cf, Depth= 8.15"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
4,985	70	Woods, Good, HSG C
46,447	74	>75% Grass cover, Good, HSG C
107	98	Roofs, HSG C
51,539	74	Weighted Average
51,432		99.79% Pervious Area
107		0.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	50	0.0220	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
2.2	75	0.0133	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	125	Total			

Subcatchment 6S: Bypass Towards Wetlands



Summary for Subcatchment 7S: To Street

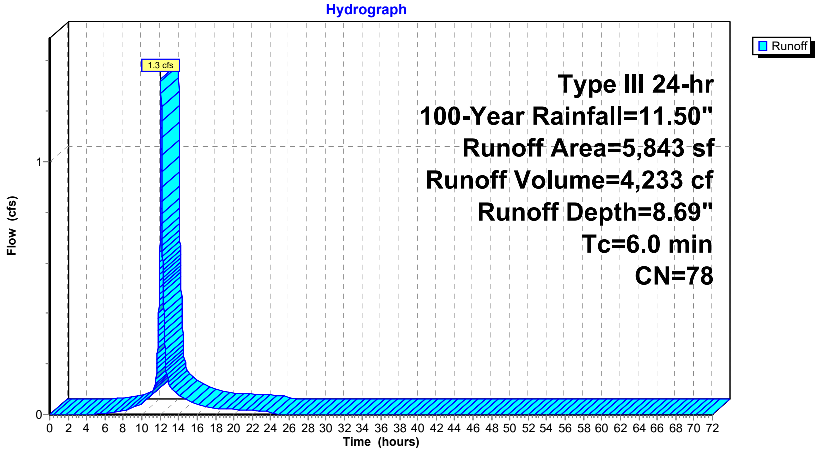
Runoff = 1.3 cfs @ 12.09 hrs, Volume= 4,233 cf, Depth= 8.69"
Routed to Link 2L : Towards Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
1,056	98	Paved parking, HSG C
4,787	74	>75% Grass cover, Good, HSG C
5,843	78	Weighted Average
4,787		81.93% Pervious Area
1,056		18.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 7S: To Street



Summary for Pond 1P: Inf Syst-1

Inflow Area = 60,436 sf, 85.36% Impervious, Inflow Depth = 10.64" for 100-Year event
Inflow = 14.8 cfs @ 12.09 hrs, Volume= 53,582 cf
Outflow = 7.4 cfs @ 12.25 hrs, Volume= 53,582 cf, Atten= 50%, Lag= 9.7 min
Discarded = 0.1 cfs @ 2.72 hrs, Volume= 15,354 cf
Primary = 7.3 cfs @ 12.25 hrs, Volume= 38,228 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 11.00' @ 12.25 hrs Surf.Area= 7,459 sf Storage= 19,245 cf

Plug-Flow detention time= 272.3 min calculated for 53,582 cf (100% of inflow)
Center-of-Mass det. time= 272.2 min (1,021.3 - 749.0)

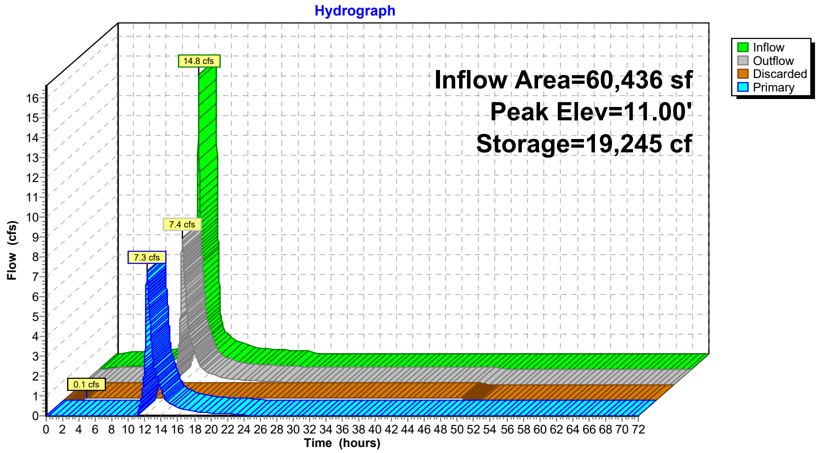
Volume	Invert	Avail.Storage	Storage Description
#1	8.00'	19,245 cf	**6.89'W x 14.06'L x 3.00'H StormTrap ST-1 Units (Irregular Shape)** x 77 22,378 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	8.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	8.00'	**15.0" Round Culvert** L= 26.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 8.00' / 7.13' S= 0.0335 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#3	Device 2	9.22'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	10.05'	**20.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 2	10.79'	**3.7' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.1 cfs @ 2.72 hrs HW=8.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=7.3 cfs @ 12.25 hrs HW=11.00' (Free Discharge)
└─**2=Culvert** (Passes 7.3 cfs of 9.1 cfs potential flow)
  ├─**3=Orifice/Grate** (Orifice Controls 3.7 cfs @ 6.12 fps)
  ├─**4=Orifice/Grate** (Orifice Controls 2.4 cfs @ 4.26 fps)
  └─**5=Sharp-Crested Rectangular Weir** (Weir Controls 1.2 cfs @ 1.51 fps)

Pond 1P: Inf Syst-1



Summary for Pond 3P: Rain garden

Inflow Area = 12,275 sf, 52.50% Impervious, Inflow Depth = 9.88" for 100-Year event
Inflow = 3.0 cfs @ 12.08 hrs, Volume= 10,109 cf
Outflow = 3.0 cfs @ 12.08 hrs, Volume= 10,109 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.0 cfs @ 12.08 hrs, Volume= 518 cf
Primary = 3.0 cfs @ 12.08 hrs, Volume= 9,592 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 6.50' @ 12.08 hrs Surf.Area= 460 sf Storage= 253 cf

Plug-Flow detention time= 29.6 min calculated for 10,108 cf (100% of inflow)
Center-of-Mass det. time= 29.8 min (803.8 - 774.0)

Volume	Invert	Avail.Storage	Storage Description
#1	5.60'	253 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

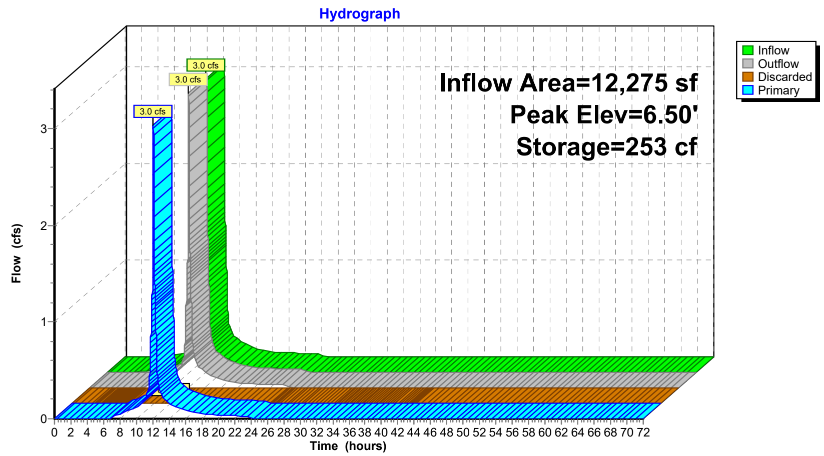
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.60	125	46.0	0	0	125
6.00	276	66.0	78	78	305
6.30	350	73.0	94	172	385
6.50	460	87.0	81	253	564

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.60'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	6.35'	**22.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.0 cfs @ 12.08 hrs HW=6.50' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=3.0 cfs @ 12.08 hrs HW=6.50' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 3.0 cfs @ 0.91 fps)

Pond 3P: Rain garden



Summary for Pond 4P: Inf Syst-2

Inflow Area = 1,112 sf, 95.68% Impervious, Inflow Depth = 11.14" for 100-Year event
Inflow = 0.3 cfs @ 12.08 hrs, Volume= 1,032 cf
Outflow = 0.3 cfs @ 12.09 hrs, Volume= 1,018 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.40 hrs, Volume= 161 cf
Primary = 0.3 cfs @ 12.09 hrs, Volume= 858 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.57' @ 12.09 hrs Surf.Area= 101 sf Storage= 136 cf

Plug-Flow detention time= 278.5 min calculated for 1,018 cf (99% of inflow)
Center-of-Mass det. time= 269.7 min (1,011.6 - 741.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

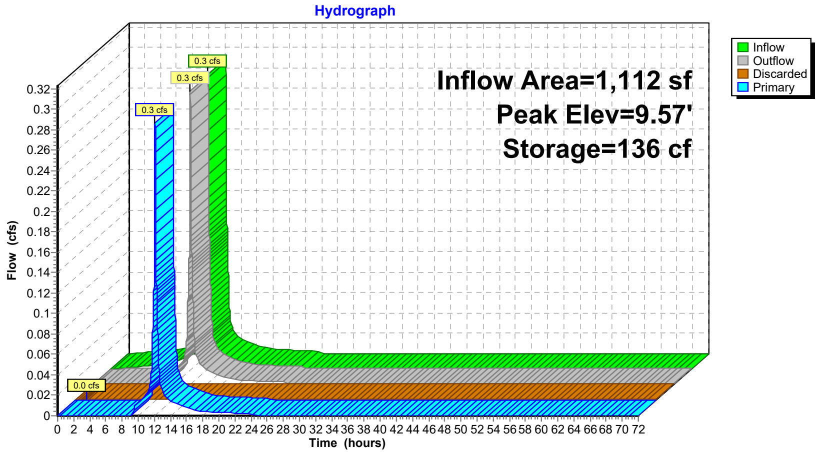
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.23'	**6.0" Round Culvert** L= 33.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.23' / 8.72' S= 0.0155 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 1.40 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.3 cfs @ 12.09 hrs HW=9.57' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.3 cfs @ 1.99 fps)

Pond 4P: Inf Syst-2



Summary for Pond 5P: Inf Syst-3

Inflow Area = 1,105 sf, 97.29% Impervious, Inflow Depth = 11.14" for 100-Year event
Inflow = 0.3 cfs @ 12.08 hrs, Volume= 1,026 cf
Outflow = 0.3 cfs @ 12.09 hrs, Volume= 1,006 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.42 hrs, Volume= 161 cf
Primary = 0.3 cfs @ 12.09 hrs, Volume= 846 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.71' @ 12.09 hrs Surf.Area= 101 sf Storage= 141 cf

Plug-Flow detention time= 286.0 min calculated for 1,006 cf (98% of inflow)
Center-of-Mass det. time= 273.7 min (1,015.6 - 741.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

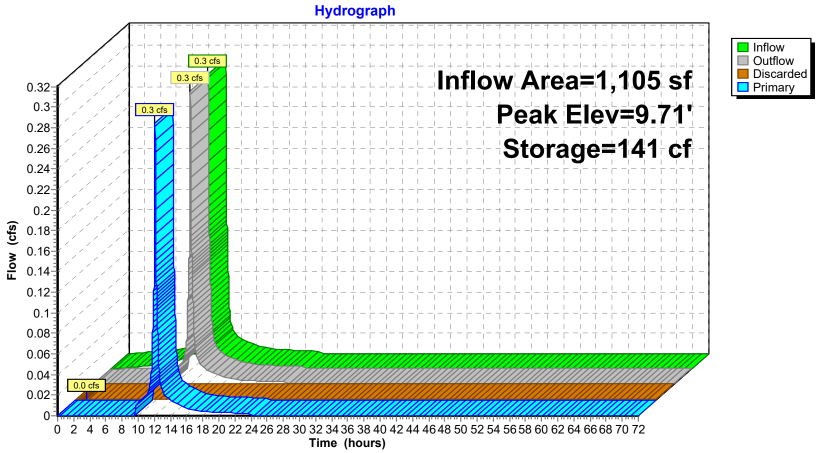
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.37'	**6.0" Round Culvert** L= 33.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.37' / 8.73' S= 0.0194 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 1.42 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.3 cfs @ 12.09 hrs HW=9.71' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.3 cfs @ 1.99 fps)

Pond 5P: Inf Syst-3



Summary for Pond 6P: Inf Syst-4

Inflow Area = 1,104 sf, 97.46% Impervious, Inflow Depth = 11.14" for 100-Year event
Inflow = 0.3 cfs @ 12.08 hrs, Volume= 1,025 cf
Outflow = 0.3 cfs @ 12.09 hrs, Volume= 1,005 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.42 hrs, Volume= 161 cf
Primary = 0.3 cfs @ 12.09 hrs, Volume= 845 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.71' @ 12.09 hrs Surf.Area= 101 sf Storage= 141 cf

Plug-Flow detention time= 285.9 min calculated for 1,005 cf (98% of inflow)
Center-of-Mass det. time= 274.0 min (1,015.8 - 741.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

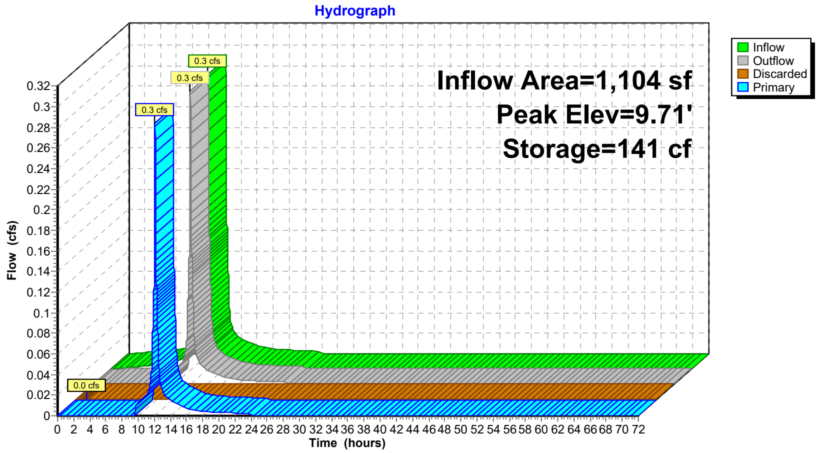
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.37'	**6.0" Round Culvert** L= 51.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.37' / 8.10' S= 0.0249 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 1.42 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.3 cfs @ 12.09 hrs HW=9.71' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.3 cfs @ 1.99 fps)

Pond 6P: Inf Syst-4



Summary for Pond 7P: Inf Syst-5

Inflow Area = 1,082 sf, 98.06% Impervious, Inflow Depth = 11.26" for 100-Year event
Inflow = 0.3 cfs @ 12.08 hrs, Volume= 1,015 cf
Outflow = 0.3 cfs @ 12.09 hrs, Volume= 1,014 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.05 hrs, Volume= 161 cf
Primary = 0.3 cfs @ 12.09 hrs, Volume= 853 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.34' @ 12.09 hrs Surf.Area= 101 sf Storage= 123 cf

Plug-Flow detention time= 271.3 min calculated for 1,014 cf (100% of inflow)
Center-of-Mass det. time= 271.0 min (1,008.3 - 737.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A** 241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1 Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf 10 Chambers in 2 Rows
		125 cf	Total Available Storage

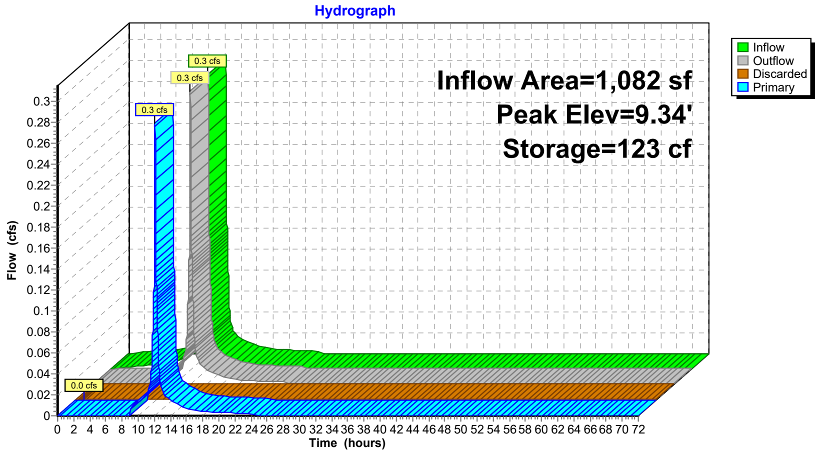
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**6.0" Round Culvert** L= 48.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.00' / 8.35' S= 0.0135 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 1.05 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.3 cfs @ 12.09 hrs HW=9.34' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.3 cfs @ 1.98 fps)

Pond 7P: Inf Syst-5



Summary for Pond 8P: Inf Syst-6

Inflow Area =	1,056 sf, 99.24% Impervious,	Inflow Depth = 11.26"	for 100-Year event
Inflow =	0.3 cfs @ 12.08 hrs, Volume=	991 cf	
Outflow =	0.3 cfs @ 12.09 hrs, Volume=	990 cf, Atten= 0%, Lag= 0.5 min	
Discarded =	0.0 cfs @ 1.08 hrs, Volume=	161 cf	
Primary =	0.3 cfs @ 12.09 hrs, Volume=	828 cf	

Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.35' @ 12.09 hrs Surf.Area= 101 sf Storage= 124 cf

Plug-Flow detention time= 277.9 min calculated for 990 cf (100% of inflow)
Center-of-Mass det. time= 277.4 min (1,014.7 - 737.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A** 241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1 Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf 10 Chambers in 2 Rows
		125 cf	Total Available Storage

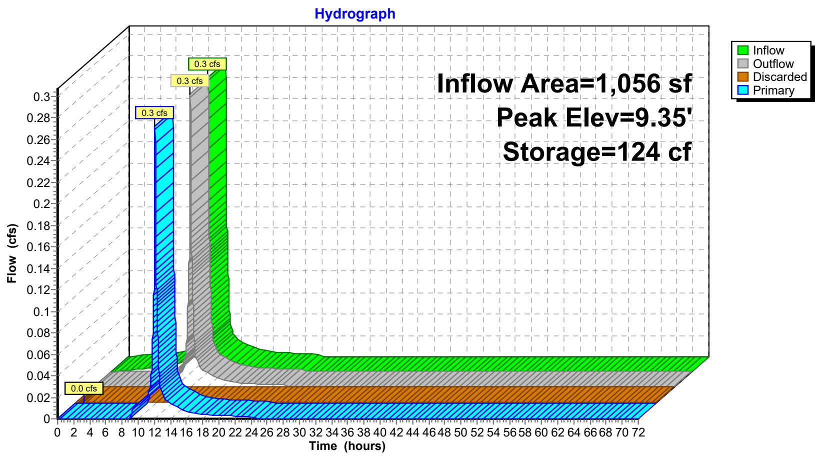
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**8.0" Round Culvert** L= 46.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.00' / 8.77' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 1.08 hrs HW=7.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.3 cfs @ 12.09 hrs HW=9.35' (Free Discharge)
└**2=Culvert** (Barrel Controls 0.3 cfs @ 2.11 fps)

Pond 8P: Inf Syst-6



Summary for Pond 9P: Inf Syst-7

Inflow Area = 24,131 sf, 72.87% Impervious, Inflow Depth = 10.41" for 100-Year event
Inflow = 6.1 cfs @ 12.08 hrs, Volume= 20,942 cf
Outflow = 3.4 cfs @ 12.20 hrs, Volume= 20,942 cf, Atten= 44%, Lag= 7.0 min
Discarded = 0.0 cfs @ 3.41 hrs, Volume= 1,621 cf
Primary = 3.4 cfs @ 12.20 hrs, Volume= 19,322 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 8.86' @ 12.20 hrs Surf.Area= 2,422 sf Storage= 3,555 cf

Plug-Flow detention time= 43.5 min calculated for 20,940 cf (100% of inflow)
Center-of-Mass det. time= 43.6 min (806.2 - 762.6)

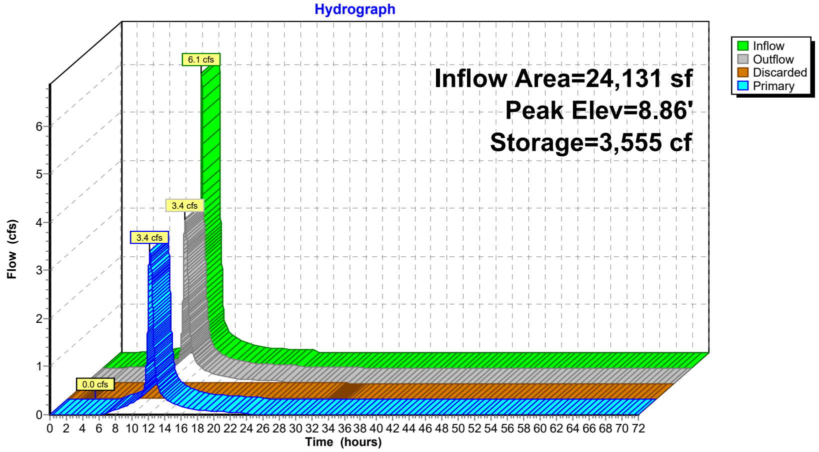
Volume	Invert	Avail.Storage	Storage Description
#1	7.15'	3,645 cf	**6.89'W x 14.06'L x 1.75'H StormTrap ST-1 Units (Irregular Shape)** x 25 4,238 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.15'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	7.15'	**12.0" Round Culvert** L= 4.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.15' / 7.13' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	7.35'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 3.41 hrs HW=7.17' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=3.4 cfs @ 12.20 hrs HW=8.86' (Free Discharge)
└─**2=Culvert** (Passes 3.4 cfs of 4.2 cfs potential flow)
  └─**3=Orifice/Grate** (Orifice Controls 3.4 cfs @ 5.57 fps)

Pond 9P: Inf Syst-7

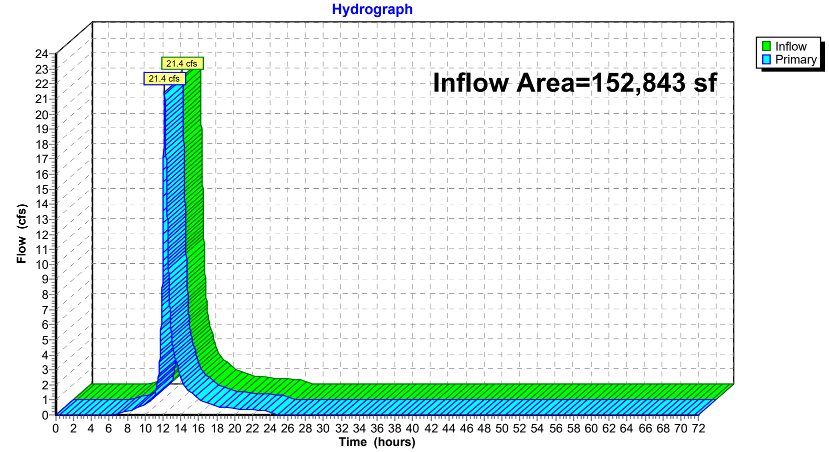


Summary for Link 1L: Towards Wetlands

Inflow Area = 152,843 sf, 50.79% Impervious, Inflow Depth = 8.30" for 100-Year event
Inflow = 21.4 cfs @ 12.19 hrs, Volume= 105,660 cf
Primary = 21.4 cfs @ 12.19 hrs, Volume= 105,660 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 1L: Towards Wetlands

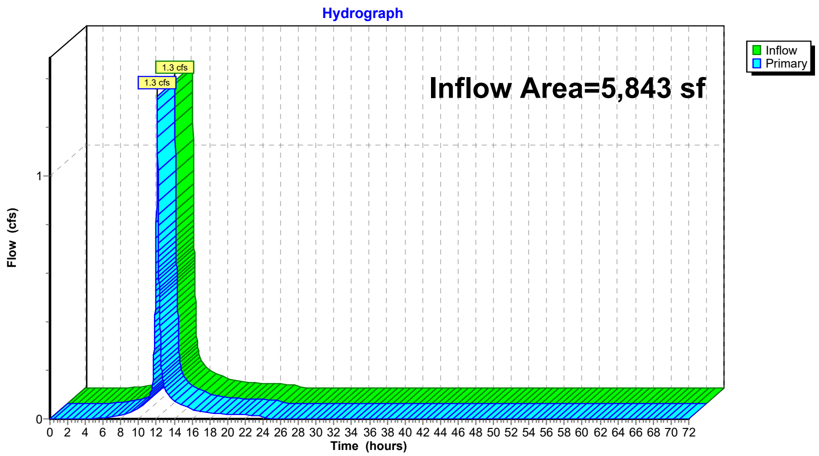


Summary for Link 2L: Towards Street

Inflow Area = 5,843 sf, 18.07% Impervious, Inflow Depth = 8.69" for 100-Year event
Inflow = 1.3 cfs @ 12.09 hrs, Volume= 4,233 cf
Primary = 1.3 cfs @ 12.09 hrs, Volume= 4,233 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 2L: Towards Street

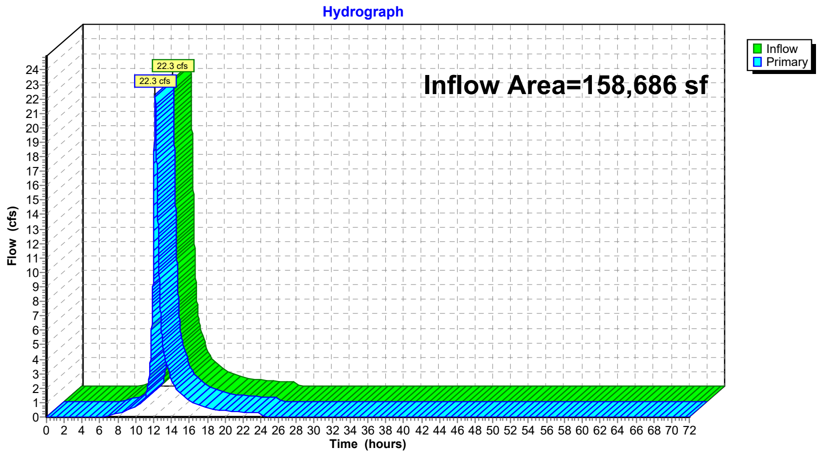


Summary for Link 100L: Total Flows

Inflow Area = 158,686 sf, 49.59% Impervious, Inflow Depth = 8.31" for 100-Year event
Inflow = 22.3 cfs @ 12.18 hrs, Volume= 109,893 cf
Primary = 22.3 cfs @ 12.18 hrs, Volume= 109,893 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 100L: Total Flows



SECTION 6.0

ADDITIONAL DRAINAGE CALCULATIONS

6.01 TSS REMOVAL CALCULATIONS

TSS Removal Calculation Worksheet

Location: Thorndike Place, Arlington, MA

Project: 23407.02

BSC GROUP

Prepared By: E. Derrig

Date: 12/09/2024

AREA 1 - CB-1

Total Impervious Area, Acres= 0.377

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
Deep Sump and Hooded Catchbasins	0.25	1.00	0.25	0.75
Hydrodynamic Separator	0.7	0.75	0.53	0.23
Infiltration Basin	0.8	0.23	0.18	0.05

TSS Removal = 0.96

AREA 2A - TD-1A

Total Impervious Area, Acres= 0.027

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
Hydrodynamic Separator	0.7	1.00	0.70	0.30
Infiltration Basin	0.8	0.30	0.24	0.06

TSS Removal = 0.94

AREA 2B - TD-1B

Total Impervious Area, Acres= 0.044

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
Hydrodynamic Separator	0.7	1.00	0.70	0.30

TSS Removal = 0.70

AREA 3 - TD-2-6

Total Impervious Area, Acres= 0.122

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
Infiltration Basin	0.8	1.00	0.80	0.20

TSS Removal = 0.80

AREA 4 - Bypass to Street

Total Impervious Area, Acres= 0.024

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
		1.00		

TSS Removal =

AREA 5 - East Driveway

Total Impervious Area, Acres= 0.148

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
Rain Garden	0.8	1.00	0.80	0.20

TSS Removal = 0.80

Weighted Annual Average TSS Removal Rate

[TSS Removal-1 (Area-1) + TSS Revoval-2 (Area-2)+ ….] / [Area-1 + Area-2 + ...] = 0.85

Project Site TSS Removal = 0.85

6.02 GROUNDWATER RECHARGE VOLUME CALCULATIONS

Required Recharge Volume

Rv = F x Impervious Area

Where:

Rv = Recharge Volume

F=Target Depth Factor associated with each Hydrologic Soil Group

(F=0.25-inch for Soil Type C)

Impervious Area = Proposed Pavement and Rooftop area on-site

$$Rv = \left(\frac{0.25in}{12}\right)(78{,}689sft) =$$

Rv = 1,640 cf (required recharge volume)

As not all impervious surfaces are directed to an infiltration BMP, an adjusted Required Volume must be provided. The adjusted Required Volume (Rva) is calculated as:

$$Rva = \frac{Total\ Imp.Area}{Imp.Area\ to\ BMP}\ (\mathrm{Rv}) =$$

$$Rva = \left(\frac{78{,}689sft}{75{,}617sft}\right)(1{,}640cf) =$$

$$Rva = 1{,}707\ cf$$

Storage Provided

- Underground Infiltration System 1 = 7,826 cubic feet provided
- Underground Infiltration System 2 = 122 cubic feet provided
- Underground Infiltration System 3/4 = 254 cubic feet provided (systems are the same)
- Underground Infiltration System 5/6 = 218 cubic feet provided (systems are the same)
- Underground Infiltration System 7 = 417 cubic feet provided
- **Underground Infiltration Systems Total = 8,837 cubic feet provided > 1,707 cf required**
  Rain garden not required to meet volume, but provides additional infiltration above and beyond that required.
  Refer to the HydroCAD storage table provided for more information.

Stage-Area-Storage for Pond 1P: Inf Syst-1

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
8.00	**7,459**	0	8.52	7,459	3,336
8.01	7,459	64	8.53	7,459	3,400
8.02	7,459	128	8.54	7,459	3,464
8.03	7,459	192	8.55	7,459	3,528
8.04	7,459	257	8.56	7,459	3,592
8.05	7,459	321	8.57	7,459	3,657
8.06	7,459	385	8.58	7,459	3,721
8.07	7,459	449	8.59	7,459	3,785
8.08	7,459	513	8.60	7,459	3,849
8.09	7,459	577	8.61	7,459	3,913
8.10	7,459	641	8.62	7,459	3,977
8.11	7,459	706	8.63	7,459	4,041
8.12	7,459	770	8.64	7,459	4,106
8.13	7,459	834	8.65	7,459	4,170
8.14	7,459	898	8.66	7,459	4,234
8.15	7,459	962	8.67	7,459	4,298
8.16	7,459	1,026	8.68	7,459	4,362
8.17	7,459	1,091	8.69	7,459	4,426
8.18	7,459	1,155	8.70	7,459	4,490
8.19	7,459	1,219	8.71	7,459	4,555
8.20	7,459	1,283	8.72	7,459	4,619
8.21	7,459	1,347	8.73	7,459	4,683
8.22	7,459	1,411	8.74	7,459	4,747
8.23	7,459	1,475	8.75	7,459	4,811
8.24	7,459	1,540	8.76	7,459	4,875
8.25	7,459	1,604	8.77	7,459	4,940
8.26	7,459	1,668	8.78	7,459	5,004
8.27	7,459	1,732	8.79	7,459	5,068
8.28	7,459	1,796	8.80	7,459	5,132
8.29	7,459	1,860	8.81	7,459	5,196
8.30	7,459	1,924	8.82	7,459	5,260
8.31	7,459	1,989	8.83	7,459	5,324
8.32	7,459	2,053	8.84	7,459	5,389
8.33	7,459	2,117	8.85	7,459	5,453
8.34	7,459	2,181	8.86	7,459	5,517
8.35	7,459	2,245	8.87	7,459	5,581
8.36	7,459	2,309	8.88	7,459	5,645
8.37	7,459	2,374	8.89	7,459	5,709
8.38	7,459	2,438	8.90	7,459	5,773
8.39	7,459	2,502	8.91	7,459	5,838
8.40	7,459	2,566	8.92	7,459	5,902
8.41	7,459	2,630	8.93	7,459	5,966
8.42	7,459	2,694	8.94	7,459	6,030
8.43	7,459	2,758	8.95	7,459	6,094
8.44	7,459	2,823	8.96	7,459	6,158
8.45	7,459	2,887	8.97	7,459	6,223
8.46	7,459	2,951	8.98	7,459	6,287
8.47	7,459	3,015	8.99	7,459	6,351
8.48	7,459	3,079	9.00	7,459	6,415
8.49	7,459	3,143	9.01	7,459	6,479
8.50	7,459	3,207	9.02	7,459	6,543
8.51	7,459	3,272	9.03	7,459	6,607

Stage-Area-Storage for Pond 1P: Inf Syst-1 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
9.04	7,459	6,672	9.56	7,459	10,007
9.05	7,459	6,736	9.57	7,459	10,071
9.06	7,459	6,800	9.58	7,459	10,136
9.07	7,459	6,864	9.59	7,459	10,200
9.08	7,459	6,928	9.60	7,459	10,264
9.09	7,459	6,992	9.61	7,459	10,328
9.10	7,459	7,056	9.62	7,459	10,392
9.11	7,459	7,121	9.63	7,459	10,456
9.12	7,459	7,185	9.64	7,459	10,521
9.13	7,459	7,249	9.65	7,459	10,585
9.14	7,459	7,313	9.66	7,459	10,649
9.15	7,459	7,377	9.67	7,459	10,713
9.16	7,459	7,441	9.68	7,459	10,777
9.17	7,459	7,505	9.69	7,459	10,841
9.18	7,459	7,570	9.70	7,459	10,905
9.19	7,459	7,634	9.71	7,459	10,970
9.20	7,459	7,698	9.72	7,459	11,034
9.21	7,459	7,762	9.73	7,459	11,098
$\boxed{9.22}$	$\boxed{7,459}$	$\boxed{7,826}$	9.74	7,459	11,162
9.23	7,459	7,890	9.75	7,459	11,226
9.24	7,459	7,955	9.76	7,459	11,290
9.25	7,459	8,019	9.77	7,459	11,354
9.26	7,459	8,083	9.78	7,459	11,419
9.27	7,459	8,147	9.79	7,459	11,483
9.28	7,459	8,211	9.80	7,459	11,547
9.29	7,459	8,275	9.81	7,459	11,611
9.30	7,459	8,339	9.82	7,459	11,675
9.31	7,459	8,404	9.83	7,459	11,739
9.32	7,459	8,468	9.84	7,459	11,804
9.33	7,459	8,532	9.85	7,459	11,868
9.34	7,459	8,596	9.86	7,459	11,932
9.35	7,459	8,660	9.87	7,459	11,996
9.36	7,459	8,724	9.88	7,459	12,060
9.37	7,459	8,788	9.89	7,459	12,124
9.38	7,459	8,853	9.90	7,459	12,188
9.39	7,459	8,917	9.91	7,459	12,253
9.40	7,459	8,981	9.92	7,459	12,317
9.41	7,459	9,045	9.93	7,459	12,381
9.42	7,459	9,109	9.94	7,459	12,445
9.43	7,459	9,173	9.95	7,459	12,509
9.44	7,459	9,238	9.96	7,459	12,573
9.45	7,459	9,302	9.97	7,459	12,637
9.46	7,459	9,366	9.98	7,459	12,702
9.47	7,459	9,430	9.99	7,459	12,766
9.48	7,459	9,494	10.00	7,459	12,830
9.49	7,459	9,558	10.01	7,459	12,894
9.50	7,459	9,622	10.02	7,459	12,958
9.51	7,459	9,687	10.03	7,459	13,022
9.52	7,459	9,751	10.04	7,459	13,087
9.53	7,459	9,815	10.05	7,459	13,151
9.54	7,459	9,879	10.06	7,459	13,215
9.55	7,459	9,943	10.07	7,459	13,279

Stage-Area-Storage for Pond 4P: Inf Syst-2 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
9.08	101	113	9.60	101	137
9.09	101	114	9.61	101	137
9.10	101	115	9.62	101	137
9.11	101	115	9.63	101	138
9.12	101	116	9.64	101	138
9.13	101	116	9.65	101	139
9.14	101	117	9.66	101	139
9.15	101	117	9.67	101	139
9.16	101	118	9.68	101	140
9.17	101	118	9.69	101	140
9.18	101	119	9.70	101	141
9.19	101	120	9.71	101	141
9.20	101	120	9.72	101	**141**
9.21	101	121	9.73	101	141
9.22	101	121			
9.23	101	122			
9.24	101	122			
9.25	101	122			
9.26	101	123			
9.27	101	123			
9.28	101	124			
9.29	101	124			
9.30	101	125			
9.31	101	125			
9.32	101	125			
9.33	101	126			
9.34	101	126			
9.35	101	127			
9.36	101	127			
9.37	101	127			
9.38	101	128			
9.39	101	128			
9.40	101	129			
9.41	101	129			
9.42	101	129			
9.43	101	130			
9.44	101	130			
9.45	101	131			
9.46	101	131			
9.47	101	131			
9.48	101	132			
9.49	101	132			
9.50	101	133			
9.51	101	133			
9.52	101	133			
9.53	101	134			
9.54	101	134			
9.55	101	135			
9.56	101	135			
9.57	101	135			
9.58	101	136			
9.59	101	136			

Stage-Area-Storage for Pond 5P: Inf Syst-3 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
9.08	101	113
9.09	101	114
9.10	101	115
9.11	101	115
9.12	101	116
9.13	101	116
9.14	101	117
9.15	101	117
9.16	101	118
9.17	101	118
9.18	101	119
9.19	101	120
9.20	101	120
9.21	101	121
9.22	101	121
9.23	101	122
9.24	101	122
9.25	101	122
9.26	101	123
9.27	101	123
9.28	101	124
9.29	101	124
9.30	101	125
9.31	101	125
9.32	101	125
9.33	101	126
9.34	101	126
9.35	101	127
9.36	101	127
9.37	101	127
9.38	101	128
9.39	101	128
9.40	101	129
9.41	101	129
9.42	101	129
9.43	101	130
9.44	101	130
9.45	101	131
9.46	101	131
9.47	101	131
9.48	101	132
9.49	101	132
9.50	101	133
9.51	101	133
9.52	101	133
9.53	101	134
9.54	101	134
9.55	101	135
9.56	101	135
9.57	101	135
9.58	101	136
9.59	101	136
9.60	101	137
9.61	101	137
9.62	101	137
9.63	101	138
9.64	101	138
9.65	101	139
9.66	101	139
9.67	101	139
9.68	101	140
9.69	101	140
9.70	101	141
9.71	101	141
9.72	101	**141**
9.73	101	141
9.74	101	141
9.75	101	141
9.76	101	141
9.77	101	141
9.78	101	141
9.79	101	141
9.80	101	141
9.81	101	141
9.82	101	141
9.83	101	141
9.84	101	141
9.85	101	141
9.86	101	141
9.87	101	141

Stage-Area-Storage for Pond 7P: Inf Syst-5

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
7.00	**101**	0
7.05	101	2
7.10	101	4
7.15	101	6
7.20	101	8
7.25	101	10
7.30	101	13
7.35	101	16
7.40	101	19
7.45	101	21
7.50	101	24
7.55	101	27
7.60	101	30
7.65	101	33
7.70	101	35
7.75	101	38
7.80	101	41
7.85	101	44
7.90	101	47
7.95	101	50
8.00	101	52
8.05	101	55
8.10	101	58
8.15	101	61
8.20	101	64
8.25	101	67
8.30	101	69
8.35	101	72
8.40	101	75
8.45	101	78
8.50	101	81
8.55	101	83
8.60	101	86
8.65	101	89
8.70	101	92
8.75	101	95
8.80	101	98
8.85	101	100
8.90	101	103
8.95	101	106
9.00	101	109
9.05	101	112
9.10	101	114
9.15	101	116
9.20	101	118
9.25	101	120
9.30	101	122
9.35	101	**124**
9.40	101	**125**
9.45	101	125
9.50	101	125

Stage-Area-Storage for Pond 9P: Inf Syst-7

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
7.15	**2,422**	0
7.17	2,422	42
7.19	2,422	83
7.21	2,422	125
7.23	2,422	167
7.25	2,422	208
7.27	2,422	250
7.29	2,422	292
7.31	2,422	333
7.33	2,422	375
7.35	2,422	417
7.37	2,422	458
7.39	2,422	500
7.41	2,422	542
7.43	2,422	583
7.45	2,422	625
7.47	2,422	666
7.49	2,422	708
7.51	2,422	750
7.53	2,422	791
7.55	2,422	833
7.57	2,422	875
7.59	2,422	916
7.61	2,422	958
7.63	2,422	1,000
7.65	2,422	1,041
7.67	2,422	1,083
7.69	2,422	1,125
7.71	2,422	1,166
7.73	2,422	1,208
7.75	2,422	1,250
7.77	2,422	1,291
7.79	2,422	1,333
7.81	2,422	1,375
7.83	2,422	1,416
7.85	2,422	1,458
7.87	2,422	1,500
7.89	2,422	1,541
7.91	2,422	1,583
7.93	2,422	1,625
7.95	2,422	1,666
7.97	2,422	1,708
7.99	2,422	1,750
8.01	2,422	1,791
8.03	2,422	1,833
8.05	2,422	1,875
8.07	2,422	1,916
8.09	2,422	1,958
8.11	2,422	1,999
8.13	2,422	2,041
8.15	2,422	2,083
8.17	2,422	2,124
8.19	2,422	2,166
8.21	2,422	2,208
8.23	2,422	2,249
8.25	2,422	2,291
8.27	2,422	2,333
8.29	2,422	2,374
8.31	2,422	2,416
8.33	2,422	2,458
8.35	2,422	2,499
8.37	2,422	2,541
8.39	2,422	2,583
8.41	2,422	2,624
8.43	2,422	2,666
8.45	2,422	2,708
8.47	2,422	2,749
8.49	2,422	2,791
8.51	2,422	2,833
8.53	2,422	2,874
8.55	2,422	2,916
8.57	2,422	2,958
8.59	2,422	2,999
8.61	2,422	3,041
8.63	2,422	3,083
8.65	2,422	3,124
8.67	2,422	3,166
8.69	2,422	3,207
8.71	2,422	3,249
8.73	2,422	3,291
8.75	2,422	3,332
8.77	2,422	3,374
8.79	2,422	3,416
8.81	2,422	3,457
8.83	2,422	3,499
8.85	2,422	3,541
8.87	2,422	3,582
8.89	2,422	**3,624**

Drawdown Within 72-Hours

Pond 1P

Rv = Recharge Volume, 7,826 cu.ft. (see above)

K = Saturated Hydraulic Conductivity, 0.27 in/hr (from Rawls Table) = 0.0225 ft/hr

Bottom Area = Area of Infiltration System Bottom, 7,459 sq.ft. (see HydroCAD)

$$Time = \frac{Rv}{(K)(Bottom\ Area)}$$

$$Time = \left(\frac{7{,}826\ cu.ft.}{(0.0225\ ft/hr)(7{,}459 sq.ft.)}\right) =$$

$$Time = 46.6\ hours$$

- 46.6 hours < 72 hours

Pond 3P (Rain Garden)

Rv = Recharge Volume, 190 cu.ft. (see HydroCAD)

K = Saturated Hydraulic Conductivity, 0.27 in/hr (from Rawls Table) = 0.0225 ft/hr

Bottom Area = Area of Infiltration System Bottom, 125 sq.ft. (see HydroCAD)

$$Time = \frac{Rv}{(K)(Bottom\ Area)}$$

$$Time = \left(\frac{190\ cu.ft.}{(0.0225\ ft/hr)(125 sq.ft.)}\right) =$$

$$Time = 67.6\ hours$$

- 67.6 hours < 72 hours

<u>Pond 4P-6P (Townhouse Trench Drain Infiltration Systems)</u>
Same bottom area, worst case provided

Rv = Recharge Volume, 127 cu.ft. (see above)

K = Saturated Hydraulic Conductivity, 0.27 in/hr (from Rawls Table) = 0.0225 ft/hr

Bottom Area = Area of Infiltration System Bottom, 100.75 sq.ft.

$$Time = \frac{Rv}{(K)(Bottom\ Area)}$$

$$Time = \left(\frac{127\ cu.ft.}{(0.0225\ ft/hr)(100.75sq.ft.)}\right) =$$

$$Time = 56.0\ hours$$

- 56.0 hours < 72 hours

<u>Pond 7P</u>

Rv = Recharge Volume, 417 cu.ft (see HydroCAD)

K = Saturated Hydraulic Conductivity, 0.27 in/hr (from Rawls Table) = 0.0225 ft/hr

Bottom Area = Area of Infiltration System Bottom, 2,421.8 sq.ft.

$$Time = \frac{Rv}{(K)(Bottom\ Area)}$$

$$Time = \left(\frac{417\ cu.ft.}{(0.0225\ ft/hr)(2{,}421sq.ft.)}\right) =$$

$$Time = 7.7\ hours$$

- 7.7 hours < 72 hours

6.03 WATER QUALITY VOLUME CALCULATIONS

Water Quality Volume Calculation

V_{WQ} = (D_{WQ}/12 inches/foot) * (A_{IMP} square feet)

V_{WQ} = Required Water Quality Volume (in cubic feet)
D_{WQ} = Water Quality Depth: **0.5-inch**
A_{IMP} = Total Impervious Area (in acres) used for driveways, parking, etc.

Underground Infiltration Systems and Bio-Retention Areas

A_{IMP} = 32,590 sq.ft.

V_{WQ} = (0.5 inches/12 inches/foot) * (32,590 sq.ft.)

V_{WQ} = 1,358 cubic feet (required volume)

Provided volume = 8,783 cubic feet in Underground Infiltration System (refer to the HydroCAD storage tables provided in groundwater recharge section)

6.04 RIP-RAP OUTLET PROTECTION SIZING

OUTLET PROTECTION SIZING

BSC GROUP

Project No.	23407.02	**Calc By**	EAD
Subject	Outlet Protection Sizing Calcs	**Date**	12/16/2024
Location	Arlington, MA	**Checked by**	DRR
		Date	12/16/2024

FES-1

Q=Design Discharge, (ft^3/s) = 11.1 cfs
D=Culvert Diameter, (ft) = 1.50 ft
TW=Tailwater Depth, (ft) = 0.6 ft, (0.4xD for unknow tailwater, or enter known tailwater)
(Tailwater depth is to be limited to between 0.4D and 1.0D)

Riprap Rock Sizing

$$D_{50} = 0.2D\left[\frac{Q}{\sqrt{g}D^{2.5}}\right]^{4/3}\left[\frac{D}{TW}\right]$$

g=32.2 fps
D_{50} = median rock size, ft

$$D_{50} = 0.28 \left|\frac{11.10}{15.64}\right|^{(4/3)} \left|\frac{1.50}{0.60}\right| = 0.44 \text{ ft}$$

= 5.32 inches

Table 1 : Riprap Classes and Apron Dimensions

Class	D_{50} (in)	Apron Length	Apron Depth	
1	5	4D	$3.5D_{50}$	
2	**6**	**4D**	**$3.5D_{50}$**	**Use Class 2**
3	10	5D	$3.3D_{50}$	
4	14	6D	$2.2D_{50}$	
5	20	7D	$2.0D_{50}$	
6	22	8D	$2.0D_{50}$	

Apron Dimensions

Length, L=5D	=	**8 ft**	
Depth=$3.3D_{50}$	=	**19.80 Inches**	
Width=3D+(2/3)L	=	**9.50 ft**	(at apron end)

Riprap Rock Sizing Gradation

Given Size	Size of Stone, inches		
100	**9**	to	**12**
85	**8**	to	**11**
50	**6**	to	**9**
15	**3**	to	**8**

Reference Note: Sizing based in accordance with HEC #14 as required by MassHighway Design Manual

6.05 GROUNDWATER MOUNDING ANALYSIS

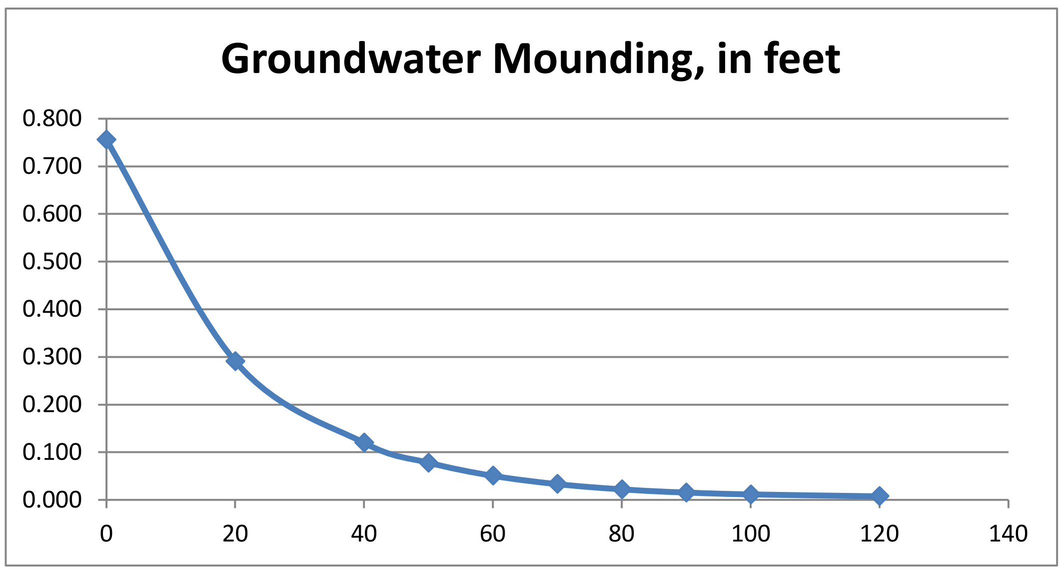
Input Values			inch/hour	feet/day	
1.5979	*R*	Recharge (infiltration) rate (feet/day)	0.67	1.33	
0.080	Sy	Specific yield, Sy (dimensionless, between 0 and 1)			
5.40	K	Horizontal hydraulic conductivity, Kh (feet/day)*	2.00	4.00	In the repor
6.920	x	1/2 length of basin (x direction, in feet)			(USGS SIR 2(
3.640	y	1/2 width of basin (y direction, in feet)	hours	days	(ft/d) is assu
1.000	t	duration of infiltration period (days)	36	1.50	hydraulic co
16.000	hi(0)	initial thickness of saturated zone (feet)			

16.756	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
0.756	Δh(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)

ESHGW=4.0
Bot System=7.0
Separation=3.0
Mound=0.756 < 3.0

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
0.756	0
0.291	20
0.120	40
0.078	50
0.051	60
0.033	70
0.022	80
0.015	90
0.012	100
0.008	120

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

Recharge/Infiltration Rate (ft/day) = [Required Recharge Volume (cft)/Bottom Recharge System (sft)]/Duration (day)

100 year recharge volume	161	cft
Bottom Recharge System	100.755	sft
Duration	1	day
Recharge/Infiltration Rate	**1.5979**	**ft/day**

Horizontal Hydraulic Conductivity (ft/day) = [Rawls Rate (in/hr) * (1ft/12in) * (24hr/1day)] * 10

Rawls Rate (silt loam)	0.27	in/hr
Horizontal Hydraulic Conductivity	**5.40**	**ft/day**

NOTE: All driveway infiltration systems are the same size and have the same discarded volume in the 100-year event

Summary for Pond 8P: Inf Syst-6

Inflow Area =	1,056 sf,	99.24% Impervious,	Inflow Depth = 11.26" for 100-Year event
Inflow =	0.3 cfs @ 12.08 hrs,	Volume=	991 cf
Outflow =	0.3 cfs @ 12.09 hrs,	Volume=	990 cf, Atten= 0%, Lag= 0.5 min
Discarded =	0.0 cfs @ 1.08 hrs,	Volume=	161 cf
Primary =	0.3 cfs @ 12.09 hrs,	Volume=	828 cf

Routed to Pond 1P : Underground Infiltration System

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.35' @ 12.09 hrs Surf.Area= 101 sf Storage= 124 cf

Plug-Flow detention time= 277.9 min calculated for 990 cf (100% of inflow)
Center-of-Mass det. time= 277.4 min (1,014.7 - 737.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A** 241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1 Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf 10 Chambers in 2 Rows
		125 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**8.0" Round Culvert** L= 46.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.00' / 8.77' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 1.08 hrs HW=7.03' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.3 cfs @ 12.09 hrs HW=9.35' (Free Discharge)
↑—**2=Culvert** (Barrel Controls 0.3 cfs @ 2.11 fps)

Infiltration System 7

Input Values			inch/hour	feet/day
0.6631	*R*	Recharge (infiltration) rate (feet/day)	0.67	1.33
0.080	Sy	Specific yield, Sy (dimensionless, between 0 and 1)		
5.40	K	Horizontal hydraulic conductivity, Kh (feet/day)*	2.00	4.00
17.225	x	1/2 length of basin (x direction, in feet)		
35.150	y	1/2 width of basin (y direction, in feet)	hours	days
1.000	t	duration of infiltration period (days)	36	1.50
16.000	hi(0)	initial thickness of saturated zone (feet)		

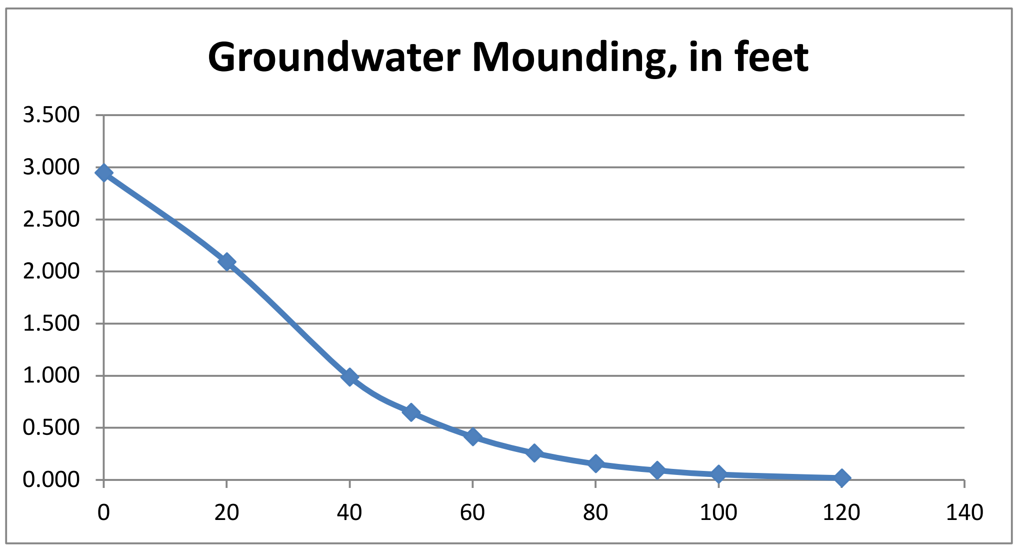
In the repor
(USGS SIR 2(
(ft/d) is assu
hydraulic co

18.946	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
2.946	Δh(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
2.946	0
2.091	20
0.985	40
0.647	50
0.413	60
0.256	70
0.154	80
0.091	90
0.052	100
0.017	120

ESHGW=4.0
Bottom System=7.15
Separation=3.15
Mound=2.946 < 3.15

Re-Calculate Now



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Recharge/Infiltration Rate (ft/day) = [Required Recharge Volume (cft)/Bottom Recharge System (sft)]/Duration (day)

100 year recharge volume	1,606	cft
Bottom Recharge System	2,421.835	sft
Duration	1	day
Recharge/Infiltration Rate	**0.6631**	**ft/day**

Horizontal Hydraulic Conductivity (ft/day) = [Rawls Rate (in/hr) * (1ft/12in) * (24hr/1day)] * 10

Rawls Rate (silt loam)	0.27	in/hr
Horizontal Hydraulic Conductivity	**5.40**	**ft/day**

Summary for Pond 9P: Inf Syst-7

Inflow Area = 24,698 sf, 71.15% Impervious, Inflow Depth = 10.36" for 100-Year event
Inflow = 6.3 cfs @ 12.08 hrs, Volume= 21,328 cf
Outflow = 3.5 cfs @ 12.20 hrs, Volume= 21,328 cf, Atten= 45%, Lag= 7.1 min
Discarded = 0.0 cfs @ 3.69 hrs, Volume= 1,606 cf
Primary = 3.5 cfs @ 12.20 hrs, Volume= 19,722 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 8.89' @ 12.20 hrs Surf.Area= 2,422 sf Storage= 3,633 cf

Plug-Flow detention time= 43.0 min calculated for 21,325 cf (100% of inflow)
Center-of-Mass det. time= 43.1 min (806.8 - 763.8)

Volume	Invert	Avail.Storage	Storage Description
#1	7.15'	5,207 cf	**6.89'W x 14.06'L x 2.50'H StormTrap ST-1 Units (Irregular Shape)** x 25 6,055 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.15'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	7.15'	**12.0" Round Culvert** L= 4.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.15' / 7.13' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	7.35'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 3.69 hrs HW=7.18' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=3.5 cfs @ 12.20 hrs HW=8.89' (Free Discharge)
└─**2=Culvert** (Passes 3.5 cfs of 4.2 cfs potential flow)
  └─**3=Orifice/Grate** (Orifice Controls 3.5 cfs @ 5.65 fps)

Specific Yield--

Compilation of Specific

Yields for Various

Materials

GEOLOGICAL SURVEY WATER SUPPLY PAPER 1662-D

Prepared in cooperation with the California Department of Water Resources

TABLE 29.—*Compilation of specific yields for various materials*

[All values rounded off to nearest whole percentage]

Material	Valley fill, California (Eckis, 1934)	Mokelumne area, California (Piper and others, 1939)	Santa Ynez River basin, California (Upson and Thomasson, 1951)	Sacramento Valley, Calif. (Poland and others, 1949)	Smith River plain, California (Back, 1957)	Ventura County, Calif. (Calif. Water Resources Board, 1956)	Santa Margarita Valley, Calif. (Calif. Dept. Public Works, 1956)	Tia Juana Basin, Calif. (Calif. Water Rights Board. 1957)	San Luis Obispo County, Calif. (Calif. Water Resources Board, 1958)	San Joaquin Valley, Calif. (Davis and others, 1959)	Eureka area, California (Evenson, 1959)	Santa Ynez Basin, Calif. (Wilson, 1959)	Rechna Doab, Pakistan (Kazmi, 1961)	Napa-Sonoma Valleys, Calif. (Kunkel and Upson, 1960)	Humboldt River Valley, Nev. (Cohen, 1963)	Unconsolidated alluvium (Preuss and Todd, 1963)	Little Bighorn River valley, Montana (Moulder and Others, 1960)	Average specific yield
Clay	1	4	2	3	1	0	1	1	3	3	3	5	3	3	1	-----	-----	2
Silt	10	4	12	3	-----	3	10	10	5	5	10	5	5	5	19	4	17	8
Sandy clay	10	4	12	3	5	5	5	5	5	5	10	-----	-----	10	-----	-----	-----	7
Fine sand	21	26	12	10	10	25	28	25	25	10	20	20	27	20	26	23	32	21
Medium sand	31	26	30	20	15	25	28	30	25	25	20	30	28	20	28	28	32	26
Coarse sand	31	35	35	20	25	25	28	32	25	25	20	30	23	20	27	28	32	27
Gravelly sand	31	35	35	20	25	21	22	28	21	25	20	-----	23	20	-----	22	32	25
Fine gravel	27	35	35	25	25	21	22	26	21	25	25	25	26	25	19	17	25	25
Medium gravel	21	-----	-----	25	25	21	22	23	21	25	25	25	26	25	-----	13	25	23
Coarse gravel	14	-----	-----	25	25	21	22	18	21	25	25	25	26	25	-----	12	-----	22

6.06 ILLICIT DISCHARGE COMPLIANCE STATEMENT

Illicit Discharge Compliance Statement

This statement is to document that, to the best of my knowledge and belief, there are no and will be no illicit discharges to the stormwater management systems or protected wetland resource areas for the Thorndike Place residential development on Dorothy Road in Arlington, Massachusetts.

Authorized Signature/Title

Date

APPENDIX A

USGS LOCUS MAP

PREPARED FOR:

ARLINGTON LAND REALTY, LLC
84 SHERMAN ST, 2ND FLOOR
CAMBRIDGE, MA 02140

USGS LOCUS MAP

THRONDIKE PLACE
DOROTHY ROAD
ARLINGTON, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

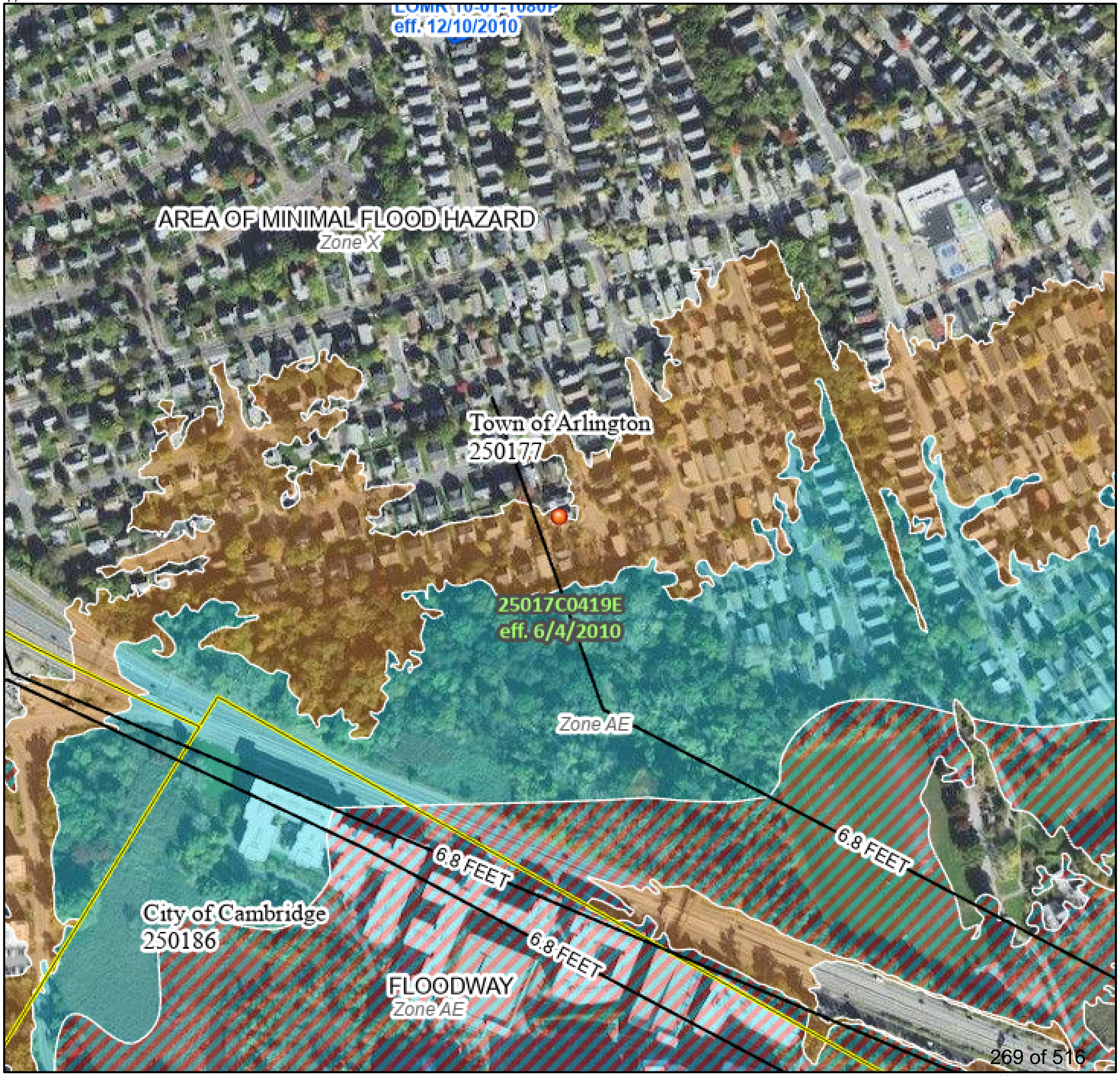
Job No.: 23407.02
Date: 08/22/2023
Scale: 1"=1,000'
Revised:
Dwg. No:
Figure: 1 OF 1

File: 2340702/C/D/2340702–USGS

APPENDIX B

FEMA MAP

FEMA


LOMR 10-01-1080P
eff. 12/10/2010
AREA OF MINIMAL FLOOD HAZARD
Zone X
Town of Arlington
250177
25017C0419E
eff. 6/4/2010
Zone AE
6.8 FEET
6.8 FEET
6.8 FEET
City of Cambridge
250186
FLOODWAY
Zone AE

APPENDIX C

WEB SOIL SURVEY

United States Department of Agriculture

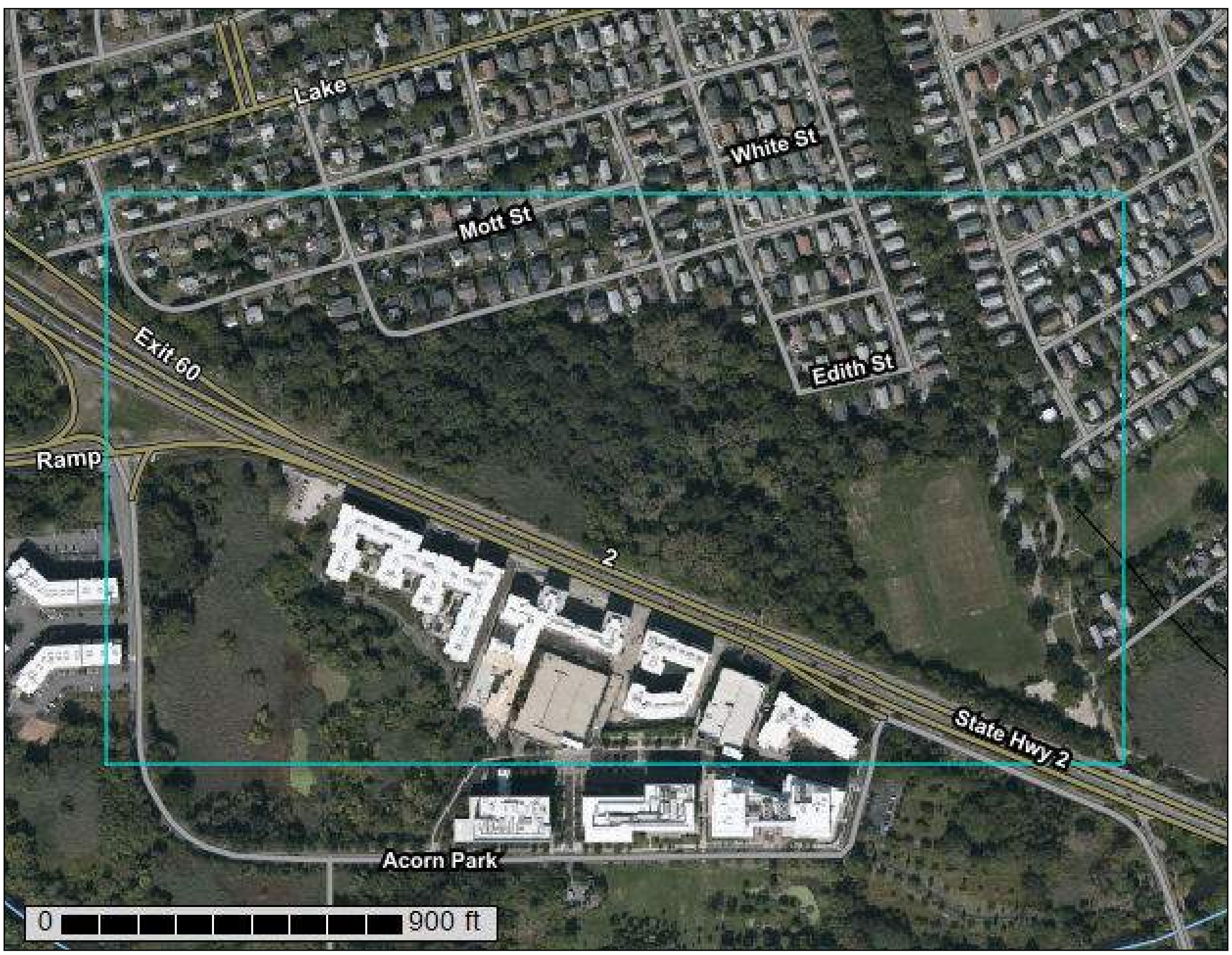
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Middlesex County, Massachusetts



November 2, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map


71° 9' 17" W
71° 8' 34" W
42° 24' 12" N
42° 23' 51" N
322700
322800
322900
323000
323100
323200
323300
323400
323500
323600
4696800
4696700
4696600
4696500
4696400
4696300
4696200
Lake
Mary St
Parker St
Exit 60
2
State Hwy 2
626B
603
655
51A
52A
Soil Map may not be valid at this scale.
Map Scale: 1:4,500 if printed on A landscape (11" x 8.5") sheet.
N
0
50
100
200
300
Meters
0
200
400
800
1200
Feet
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 20, Jun 9, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 11, 2019—Oct 5, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
51A	Swansea muck, 0 to 1 percent slopes	4.3	4.6%
52A	Freetown muck, 0 to 1 percent slopes	10.4	11.2%
603	Urban land, wet substratum	32.1	34.5%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	14.3	15.4%
655	Udorthents, wet substratum	31.9	34.3%
Totals for Area of Interest		**92.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Middlesex County, Massachusetts

51A—Swansea muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2trl2
Elevation: 0 to 1,140 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Swansea and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Swansea

Setting

Landform: Swamps, bogs
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material over loose sandy and gravelly glaciofluvial deposits

Typical profile

Oa1 - 0 to 24 inches: muck
Oa2 - 24 to 34 inches: muck
Cg - 34 to 79 inches: coarse sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water capacity: Very high (about 16.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands
Hydric soil rating: Yes

Minor Components

Freetown

Percent of map unit: 10 percent
Landform: Bogs, swamps

Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

52A—Freetown muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t2q9
Elevation: 0 to 1,110 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Freetown and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Freetown

Setting

Landform: Depressions, depressions, bogs, marshes, kettles, swamps
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material

Typical profile

Oe - 0 to 2 inches: mucky peat
Oa - 2 to 79 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water capacity: Very high (about 19.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands
Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 5 percent
Landform: Kettles, depressions, depressions, marshes, swamps, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

603—Urban land, wet substratum

Map Unit Setting

National map unit symbol: 9951
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land over alluvium and/or marine deposits

Minor Components

Udorthents, loamy

Percent of map unit: 10 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 5 percent
Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave

626B—Merrimac-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyr9
Elevation: 0 to 820 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Merrimac and similar soils: 45 percent
Urban land: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Eskers, moraines, outwash terraces, outwash plains, kames
Landform position (two-dimensional): Backslope, footslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 0 inches to manufactured layer

Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water capacity: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Windsor

Percent of map unit: 5 percent
Landform: Dunes, outwash terraces, deltas, outwash plains
Landform position (three-dimensional): Tread, riser
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Outwash plains, terraces, deltas
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Eskers, kames, deltas, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

655—Udorthents, wet substratum

Map Unit Setting

National map unit symbol: vr1n
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, wet substratum, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Wet Substratum

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Minor Components

Urban land

Percent of map unit: 8 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Freetown

Percent of map unit: 4 percent
Landform: Depressions, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 3 percent
Landform: Bogs, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

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APPENDIX D

TEST PIT LOGS

Commonwealth of Massachusetts
City/Town of Arlington

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Arlington Land Realty, LLC
Owner Name

Dorothy Road
Street Address

16-8-2, 16-8-3, 16-8-4, 16-8-5, 16-8-6, 16-8-7A
Map/Lot #

Arlington
City

MA
State

02474
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: Web Soil Survey (Source) 655, 51A (Soil Map Unit)

   Udorthents, Swansea Muck
   Soil Name

   Fill throughout site; clay base layer in one test pit
   Soil Limitations

   Glaciofluvial deposit
   Soil Parent material

   Depression
   Landform

3. Surficial Geological Report Available? ☒ Yes ☐ No If yes: 2018/USGS (Year Published/Source) Glaciomarine fine deposits, stagnant ice deposits (Map Unit)

   fine/very fine sand down to very fine sand, silt, silty clay, and clay
   Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☒ Yes ☐ No If yes, MassGIS Wetland Data Layer: Shallow marsh meadow (Wetland Type)

7. Current Water Resource Conditions (USGS): 11/25/2020 (Month/Day/ Year) Range: ☒ Above Normal ☐ Normal ☐ Below Normal

8. Other references reviewed: Not in Zone I, II, or IWPA (OLIVER)

Commonwealth of Massachusetts
City/Town of Arlington

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-1 (Hole #) 11/25/2020 (Date) 7:45 AM (Time) Cloudy, 30deg (Weather) 42.40 N (Latitude) 71.15 W (Longitude:)

1. Land Use Woodland adjacent to residential/highway (e.g., woodland, agricultural field, vacant lot, etc.) Forest (Vegetation) Some large boulders (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-2% (Slope (%))

   Description of Location: ______

2. Soil Parent Material: Glaciofluvial deposits Depression (Landform) SU (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands >100 feet
   Property Line >100 feet Drinking Water Well >100 feet Other ______ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 108" Depth Weeping from Pit 108" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0"-10	A	SL	7.5YR 2.5/1	--	--	--	0	0	massive	friable	
10"-36"	B (fill)	gravelly sandy loam	10YR 3/3	--	--	--	10	2-4	massive	very friable	
36"-48"											
48"-108"	C1 (fill)	gravelly sandy loam	10YR 2/1	--	--	--	15-20	4-6	massive	very friable	
36"-78"	C2 (fill)	loamy sand	10YR 5/4	--	--	--	0	0	single grain	loose	sandy layer (only on E side of test pit)
78"-108"	2C2 (fill)	gravelly sandy loam	10YR 2/1	--	--	--	15-20	4-6	massive	very friable	gravelly layer below sandy layer on E side of test pit

Additional Notes:
Elevation of TP-1 = 12.0. Groundwater at bottom of test pit (9' - elevation 3.0). Test pit mostly fill

Commonwealth of Massachusetts
City/Town of Arlington

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-2 (Hole #) 11/25/2020 8:45AM (Time) Cloudy, 35deg (Weather) 42.40 N (Latitude) 71.15 W (Longitude:)

1. Land Use: Woodland adjacent to residential/highway (e.g., woodland, agricultural field, vacant lot, etc.) Forest (Vegetation) Some large boulders around (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-2% (Slope (%))

Description of Location: ______

2. Soil Parent Material: Glaciofluvial deposits Depression (Landform) SU (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands >100 feet
Property Line >100 feet Drinking Water Well >100 feet Other ______ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: ______ Depth Weeping from Pit ______ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-7	A	sandy loam	10YR 2.5/1	--	--	--	0	0	massive	friable	
7-132	C (fill)	gravelly sandy loam	10YR 3/2	--	--	--	15-20	4-6	massive	friable	

Additional Notes:
Elevation of TP-2 = 11.2. Estimated groundwater elevation (to bottom of test pit) = 0.2. Fill throughout test pit. No groundwater observed

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used: Obs. Hole # TP-1 Obs. Hole # TP-2

Method	Obs. Hole # TP-1	Obs. Hole # TP-2
☒ Depth observed standing water in observation hole	108 inches	_____ inches
☐ Depth weeping from side of observation hole	_____ inches	_____ inches
☐ Depth to soil redoximorphic features (mottles)	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_______________ Index Well Number _______________ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

2. Estimated Depth to High Groundwater: 108 inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☐ Yes ☒ No

b. If yes, at what depth was it observed (exclude A and O Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

c. If no, at what depth was impervious material observed? Upper boundary: 108 inches Lower boundary: >108 (fill material) inches

Commonwealth of Massachusetts
City/Town of Arlington

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

	11/25/2020
Signature of Soil Evaluator	Date
Emily Derrig SE14158	12/1/2020
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License
Name of Approving Authority Witness	Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:

Commonwealth of Massachusetts
City/Town of Arlington

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Arlington Land Realty, LLC
Owner Name

Dorothy Road
Street Address

16-8-2, 16-8-3, 16-8-4, 16-8-5, 16-8-6, 16-8-7A
Map/Lot #

Arlington
City

MA
State

02474
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: Web Soil Survey (Source) 655, 51A (Soil Map Unit)

   Udorthents, Swansea Muck
   Soil Name

   Fill throughout site; clay base layer in one test pit
   Soil Limitations

   Glaciofluvial deposit
   Soil Parent material

   Depression
   Landform

3. Surficial Geological Report Available? ☒ Yes ☐ No If yes: 2018/USGS (Year Published/Source) Glaciomarine fine deposits, stagnant ice deposits (Map Unit)

   fine/very fine sand down to very fine sand, silt, silty clay, and clay
   Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☒ Yes ☐ No If yes, MassGIS Wetland Data Layer: Shallow marsh meadow (Wetland Type)

7. Current Water Resource Conditions (USGS): 11/25/2020 (Month/Day/ Year) Range: ☒ Above Normal ☐ Normal ☐ Below Normal

8. Other references reviewed: Not in Zone I, II, or IWPA (OLIVER)

Commonwealth of Massachusetts
City/Town of Arlington

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-3 (Hole #) 11/25/2020 (Date) 9:45 AM (Time) Cloudy, 40deg (Weather) 42.40 N (Latitude) 71.15 W (Longitude:)

1. Land Use Woodland adjacent to residential/highway (e.g., woodland, agricultural field, vacant lot, etc.) Forest (Vegetation) Some large boulders (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-2% (Slope (%))

   Description of Location: ______

2. Soil Parent Material: Glaciofluvial deposits Depression (Landform) FS (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands >100 feet
   Property Line >100 feet Drinking Water Well >100 feet Other ______ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 84" Depth Weeping from Pit 144" Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0"-8"	A	SL	10YR 2/1	--	--	--	0	0	massive	very friable	
8"-84"	B	SL	7.5YR 2.5/2	36"	7.5YR 5/8	2-4%	2-4	0	massive	friable	
84"-108"	C1	Sandy Clay Loam	10YR 2/1	--	--	--	0	0	massive	firm	
108"-144"	C2	Clay	GLEY 2 4/5B	--	--	--	0	0	massive	very firm	

Additional Notes:
TP-3 Elevation = 6.5. Groundwater observed at bottom of test pit (12') and weeping from sides at 7' - estimated groundwater elevation = -0.5

Commonwealth of Massachusetts
City/Town of Arlington

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: ______ Hole # ______ Date ______ Time ______ Weather ______ Latitude ______ Longitude:

1. Land Use: ______ (e.g., woodland, agricultural field, vacant lot, etc.) ______ Vegetation ______ Surface Stones (e.g., cobbles, stones, boulders, etc.) ______ Slope (%)

   Description of Location: ______

2. Soil Parent Material: ______ ______ Landform ______ Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body ______ feet Drainage Way ______ feet Wetlands ______ feet

   Property Line ______ feet Drinking Water Well ______ feet Other ______ feet

4. Unsuitable Materials Present: ☐ Yes ☐ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No If yes: ______ Depth Weeping from Pit ______ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			

Additional Notes: ______

Commonwealth of Massachusetts
City/Town of Arlington

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # TP-3	Obs. Hole # _____
☒ Depth observed standing water in observation hole	132 inches	_____ inches
☒ Depth weeping from side of observation hole	84 inches	_____ inches
☐ Depth to soil redoximorphic features (mottles)	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

Index Well Number ____________ Reading Date ____________

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

2. Estimated Depth to High Groundwater: 84 inches

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☐ Yes ☒ No

b. If yes, at what depth was it observed (exclude A and O Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

c. If no, at what depth was impervious material observed? Upper boundary: 84 inches Lower boundary: 132 inches

Commonwealth of Massachusetts
City/Town of Arlington

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

	11/25/2020
Signature of Soil Evaluator	Date
Emily Derrig SE14158	12/1/2020
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License
Name of Approving Authority Witness	Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Arlington Land Realty, LLC.
Owner Name

Dorothy Road
Street Address

16-8-2, 16-8-3, 16-8-4, 16-8-5, 16-8-6, 16-8-7A
Map/Lot #

Arlington
City

MA
State

02474
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade

2. Soil Survey NRCS USDA Web Soil Survey
Source

655
Soil Map Unit

Udorthents, wet substratum
Soil Series

Depressions
Landform

Soil Limitations

Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposites and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till
Soil Parent material

3. Surficial Geological Report 2018/USGS
Year Published/Source

Artificial fill, glaciomarine fine deposits, stagnant ice deposits
Map Unit

Fine/very fine sand down to very fine sand, silt, silty clay, and clay
Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No If yes, MassGIS Wetland Data Layer:
Wetland Type

7. Current Water Resource Conditions (USGS):
Month/Day/ Year
Range: ☐ Above Normal ☐ Normal ☐ Below Normal

8. Other references reviewed: Not in Zone II or IWPA (MassMapper)
(Zone II, IWPA, Zone A, EEA Data Portal, etc.)

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-1 (Hole #) 5/18/23 (Date) 9:00AM (Time) Clear (Weather) 42.4' N (Latitude) 71.2' W (Longitude)

1. Land Use: Wooded lot in residential area (e.g., woodland, agricultural field, vacant lot, etc.) Trees (Vegetation) Some surface stones, not many (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 3% (Slope (%))

Description of Location: At the front of the site along Dorothy Road, about 32' in from the edge of the road

2. Soil Parent Material: Glaciofluvial deposits Depression (Landform) SU (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands 280 feet
Property Line 22 feet Drinking Water Well >100 feet Other ____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 108" Depth to Weeping in Hole 114" Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-90	Fill	Sandy Loam	7.5YR 3/2		Cnc : Dpl:		0	4-6	Massive	Friable	
90-120	C	Fine Sandy Loam	7.5YR 5/2		Cnc : Dpl:		0	0	Massive	Friable	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes: Top of monitoring well 3'-8" from ground surface

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-2 (Hole #) | 5/18/23 (Date) | 1:30PM (Time) | Clear (Weather) | 42.4' N (Latitude) | 71.2' W (Longitude)

1. Land Use: Wooded lot in residential area (e.g., woodland, agricultural field, vacant lot, etc.) | Trees (Vegetation) | Some surface stones, not many (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 2% (Slope (%))

Description of Location: At the front of the site along Dorothy Road, about 30' in from the edge of the road

2. Soil Parent Material: Glaciofluvial deposits | Depression (Landform) | BS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >100 feet | Drainage Way >100 feet | Wetlands 270 feet

Property Line 22 feet | Drinking Water Well >100 feet | Other ______ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: ______ Depth to Weeping in Hole 97" Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-83	Fill	Sandy Loam	10YR 3/2		Cnc : Dpl:		0	4-6	Massive	Friable	
83-104	C	Fine Sandy Loam	10YR 5/1		Cnc : Dpl:		0	0	Massive	Friable	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:
Shifted back a few feet because of boulder or buried piece of debris
Seemed like there may have been a second layer of sandy material below the point where groundwater broke into the hole

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one): Obs. Hole # TP-1 Obs. Hole # TP-2

	Obs. Hole # TP-1	Obs. Hole # TP-2
☐ Depth to soil redoximorphic features	_____ inches	_____ inches
☒ Depth to observed standing water in observation hole	108 inches	97 inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

______________________ Index Well Number ______________________ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ☐ Yes ☒ No

   b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

   c. If no, at what depth was impervious material observed? Upper boundary: 97 inches Lower boundary: 104 inches

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-3 (Hole #) 5/18/23 (Date) 2:30PM (Time) Clear (Weather) 42.4' N (Latitude) 71.2' W (Longitude)

1. Land Use: Wooded lot in residential area (e.g., woodland, agricultural field, vacant lot, etc.) — Trees (Vegetation) — Some surface stones, not many (Surface Stones (e.g., cobbles, stones, boulders, etc.)) — 6% (Slope (%))

Description of Location: At the front of the site along Dorothy Road, about 32' in from the edge of the road

2. Soil Parent Material: Glaciofluvial deposits — Depression (Landform) — BS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >100 feet — Drainage Way >100 feet — Wetlands 280 feet
Property Line 22 feet — Drinking Water Well >100 feet — Other ____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: ____ Depth to Weeping in Hole 82" Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-27	Fill	Sandy Loam	10YR 2/2		Cnc : Dpl:		0	4-6	Massive	Friable	Buried A layer at 21"
27-87	C	Fine Sandy Loam	10YR 4/3	51"	Cnc : 7.5YR5/8 Dpl:		0	0	Massive	Friable	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-4 (Hole #) 5/19/23 (Date) 8:15AM (Time) Clear (Weather) 42.4' N (Latitude) 71.2' W (Longitude)

1. Land Use: Wooded lot in residential area (e.g., woodland, agricultural field, vacant lot, etc.) Trees (Vegetation) Some surface stones, not many (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 6% (Slope (%))

Description of Location: At the front of the site along Dorothy Road, about 30' in from the edge of the road

2. Soil Parent Material: Glaciofluvial deposits Depression (Landform) TS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands 310 feet
Property Line 24 feet Drinking Water Well >100 feet Other ____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 68" Depth to Weeping in Hole 72" Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-64	Fill	Gravelly Sandy Loam	7.5YR 3/1		Cnc : Dpl:		10-15	2-4	Massive	Friable	
64-96	C	Fine Loamy Sand	10YR 4/2		Cnc : Dpl:		2-4	0	Massive	Very Friable	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):

	Obs. Hole # TP-3	Obs. Hole # TP-4
☒ Depth to soil redoximorphic features	51 inches	___ inches
☒ Depth to observed standing water in observation hole	82 inches	68 inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	___ inches	___ inches

Index Well Number ________ Reading Date ________

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☐ Yes ☒ No

b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: ______ inches Lower boundary: ______ inches

c. If no, at what depth was impervious material observed? Upper boundary: 68 inches Lower boundary: 96 inches

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-5 (Hole #) | 5/19/23 (Date) | 10:30AM (Time) | Clear (Weather) | 42.4' N (Latitude) | 71.2' W (Longitude)

1. Land Use: Wooded lot in residential area (e.g., woodland, agricultural field, vacant lot, etc.) | Trees (Vegetation) | Some surface stones, not many (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 10% (Slope (%))

Description of Location: At the front of the site along Dorothy Road, about 35' in from the edge of the road

2. Soil Parent Material: Glaciofluvial deposits | Depression (Landform) | BS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >100 feet | Drainage Way >100 feet | Wetlands 230 feet
   Property Line 24 feet | Drinking Water Well >100 feet | Other ____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 60" Depth to Weeping in Hole 60" Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-33	Fill	Gravelly Sandy Loam	10YR 3/2		Cnc : Dpl:		10	4-6	Massive	Friable	Buried A layer at 26"
33-74	C	Fine Sandy Loam	10YR 5/2	48"	Cnc : Dpl:		0	0	Massive	Friable	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-6 (Hole #) | 5/19/23 (Date) | 9:00AM (Time) | Clear (Weather) | 42.4' N (Latitude) | 71.2' W (Longitude)

1. Land Use: Wooded lot in residential area (e.g., woodland, agricultural field, vacant lot, etc.) | Trees (Vegetation) | Some surface stones, not many (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 5% (Slope (%))

Description of Location: At the front of the site along Dorothy Road, about 120' in from the edge of the road

2. Soil Parent Material: Glaciofluvial deposits | Depression (Landform) | TS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >100 feet | Drainage Way >100 feet | Wetlands 110 feet

Property Line 12 feet | Drinking Water Well >100 feet | Other ______ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 110" Depth to Weeping in Hole 110" Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-30	Fill	Gravelly Sandy Loam	7.5YR 3/2		Cnc : Dpl:		10-15	4-6	Massive	Friable	
30-132	C	Fine Sandy Loam	10YR 5/2	39"	Cnc : 7.5YR5/8 Dpl:		0	0	Massive	Friable	
				64"	Cnc : 7.5YR5/8 Dpl:						Second redox band - calling ESGW here
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:
Multiple redox bands in C horizon
Top of monitoring well 1'-8" from ground surface

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one): Obs. Hole # TP-5 Obs. Hole # TP-6

	Obs. Hole # TP-5	Obs. Hole # TP-6
[X] Depth to soil redoximorphic features	48 inches	64 inches
[X] Depth to observed standing water in observation hole	60 inches	110 inches
[ ] Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_______________ Index Well Number _______________ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   [ ] Yes [X] No

   b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

   c. If no, at what depth was impervious material observed? Upper boundary: 60 inches Lower boundary: 74 inches

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-7 (Hole #) | 5/18/23 (Date) | 11:00AM (Time) | Clear (Weather) | 42.4' N (Latitude) | 71.2' W (Longitude)

1. Land Use: Wooded lot in residential area (e.g., woodland, agricultural field, vacant lot, etc.) | Trees (Vegetation) | Some surface stones, not many (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3% (Slope (%))

Description of Location: At the front of the site along Dorothy Road, about 110' in from the edge of the road

2. Soil Parent Material: Glaciofluvial deposits | Depression (Landform) | BS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >100 feet | Drainage Way >100 feet | Wetlands 190 feet
Property Line 100 feet | Drinking Water Well >100 feet | Other ____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: ____ Depth to Weeping in Hole 110" Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features: Depth	Redoximorphic Features: Color	Redoximorphic Features: Percent	Coarse Fragments % by Volume: Gravel	Coarse Fragments % by Volume: Cobbles & Stones	Soil Structure	Soil Consistence (Moist)	Other
0-108	Fill	Gravelly Sandy Loam	7.5YR 3/1		Cnc : Dpl:		10	4-6	Massive	Friable	
108-114	C	Fine Sandy Loam	5Y 5/1		Cnc : Dpl:		0	0	Massive	Friable	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:
Sand layer was completely saturated
Top of monitoring well 4'-6" from ground surface

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-8 (Hole #) 5/18/23 (Date) 10:00AM (Time) Clear (Weather) 42.4' N (Latitude) 71.2' W (Longitude)

1. Land Use: Wooded lot in residential area (e.g., woodland, agricultural field, vacant lot, etc.) Trees (Vegetation) Some surface stones, not many (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 4% (Slope (%))

Description of Location: At the front of the site along Dorothy Road, about 110' in from the edge of the road

2. Soil Parent Material: Glaciofluvial deposits Depression (Landform) TS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands 210 feet

Property Line 98 feet Drinking Water Well >100 feet Other ______ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 112" Depth to Weeping in Hole ______ Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-120	Fill	Gravelly Sandy Loam	7.5YR 3/1		Cnc : Dpl:		10	4-6	Massive	Friable	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one): Obs. Hole # TP-7 Obs. Hole # TP-8

	Obs. Hole # TP-7	Obs. Hole # TP-8
☐ Depth to soil redoximorphic features	_____ inches	_____ inches
☒ Depth to observed standing water in observation hole	110 inches	112 inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

Index Well Number ______________ Reading Date ______________

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☐ Yes ☒ No

b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

c. If no, at what depth was impervious material observed? Upper boundary: 120 inches Lower boundary: 120 inches

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator

5/22/2023
Date

Emily Derrig, SE 14158
Typed or Printed Name of Soil Evaluator / License #

6/30/2023
Expiration Date of License

Name of Approving Authority Witness

Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Arlington Land Realty, LLC.
Owner Name

Dorothy Road
Street Address

16-8-2, 16-8-3, 16-8-4, 16-8-5, 16-8-6, 16-8-7A
Map/Lot #

Arlington
City

MA
State

02474
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade

2. Soil Survey NRCS USDA Web Soil Survey
Source
655
Soil Map Unit
Udorthents, wet substratum
Soil Series

Depressions
Landform

Soil Limitations

Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposites and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till
Soil Parent material

3. Surficial Geological Report 2018/USGS
Year Published/Source
Artificial fill, glaciomarine fine deposits, stagnant ice deposits
Map Unit

Fine/very fine sand down to very fine sand, silt, silty clay, and clay
Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No If yes, MassGIS Wetland Data Layer:
Wetland Type

7. Current Water Resource Conditions (USGS): April 17, 2024
Month/Day/ Year
Range: ☐ Above Normal ☒ Normal ☐ Below Normal

8. Other references reviewed: Not in Zone II or IWPA (MassMapper)
(Zone II, IWPA, Zone A, EEA Data Portal, etc.)

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-9 (Hole #) | 4/17/24 (Date) | 8:30AM (Time) | Clear, 50 (Weather) | 42.4' N (Latitude) | 71.2' W (Longitude)

1. Land Use: Wooded lot in residential area (e.g., woodland, agricultural field, vacant lot, etc.) | Trees (Vegetation) | Some surface stones, not many (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 7% (Slope (%))

Description of Location: Center of proposed infiltration system (large); between TP-7 and TP-8; about 110 feet from Dorothy Road

2. Soil Parent Material: Glaciofluvial deposits | Depression (Landform) | FS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >100 feet | Drainage Way >100 feet | Wetlands 205 feet
Property Line 110 feet | Drinking Water Well >100 feet | Other ____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 90" Depth to Weeping in Hole 116" Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-100	Fill	Sandy Loam	7.5YR 4/7		Cnc : Dpl:		0	4-6	Massive	Friable	
100-118	C	Fine Sandy Loam	10YR 4/1		Cnc : Dpl:		0	0	Massive	Friable	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes: Installed monitoring well; groundwater weeping from side of pit and standing water at bottom of pit

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-10 (Hole #) | 4/17/24 (Date) | 10:00 AM (Time) | Clear, 50 (Weather) | 42.4' N (Latitude) | 71.2' W (Longitude)

1. Land Use: Wooded lot in residential area (e.g., woodland, agricultural field, vacant lot, etc.) | Trees (Vegetation) | Some surface stones, not many (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 3% (Slope (%))

Description of Location: Northwest corner of infiltration system; about 100' from Dorothy Road

2. Soil Parent Material: Glaciofluvial deposits | Depression (Landform) | BS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >100 feet | Drainage Way >100 feet | Wetlands 250 feet
Property Line 79 feet | Drinking Water Well >100 feet | Other ____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 94" Depth to Weeping in Hole 126" Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-130	Fill	Sandy Loam	7.5YR 4/2		Cnc : Dpl:		0	4-6	Massive	Friable	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:
Groundwater weeping from side of hole and standing water at bottom of pit; debris and construction material present throughout fill

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one): Obs. Hole # TP-9 Obs. Hole # TP-10

☐ Depth to soil redoximorphic features _____ inches _____ inches

☒ Depth to observed standing water in observation hole 90 inches 94 inches

☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology) _____ inches _____ inches

_____________________ Index Well Number _____________________ Reading Date

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☐ Yes ☒ No

b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

c. If no, at what depth was impervious material observed? Upper boundary: 90 inches Lower boundary: 118 inches

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-11 (Hole #) 4/17/24 (Date) 10:45AM (Time) Clear, 55 (Weather) 42.4' N (Latitude) 71.2' W (Longitude)

1. Land Use: Wooded lot in residential area (e.g., woodland, agricultural field, vacant lot, etc.) Trees (Vegetation) Some surface stones, not many (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 6% (Slope (%))

Description of Location: Southwest corner of infiltration system; about 135' from Dorothy Road

2. Soil Parent Material: Glaciofluvial deposits Depression (Landform) FS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands 215 feet

   Property Line 46 feet Drinking Water Well >100 feet Other ______ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 93" Depth to Weeping in Hole 111" Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-114	Fill	Sandy Loam	7.5YR 4/2		Cnc : Dpl:		0	4-6	Massive	Friable	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-12 (Hole #) 4/17/24 (Date) 11:30AM (Time) Clear, 55 (Weather) 42.4' N (Latitude) 71.2' W (Longitude)

1. Land Use Wooded lot in residential area (e.g., woodland, agricultural field, vacant lot, etc.) Trees (Vegetation) Some surface stones, not many (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 3% (Slope (%))

Description of Location: Northeast corner of infiltration system; about 95' from Dorothy Road

2. Soil Parent Material: Glaciofluvial deposits Depression (Landform) FS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >100 feet Drainage Way >100 feet Wetlands 215 feet

Property Line 92 feet Drinking Water Well >100 feet Other ____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 53" Depth to Weeping in Hole 68" Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-76	Fill	Sandy Loam	7.5YR 3/2		Cnc : Dpl:		0	50	Massive	Friable	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:
Larger cobbles/boulders throughout test pit

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one): Obs. Hole # TP-11 Obs. Hole # TP-12

	Obs. Hole # TP-11	Obs. Hole # TP-12
☐ Depth to soil redoximorphic features	_____ inches	_____ inches
☒ Depth to observed standing water in observation hole	93 inches	53 inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_______________ Index Well Number _______________ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☐ Yes ☒ No

b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

c. If no, at what depth was impervious material observed? Upper boundary: 53 inches Lower boundary: 76 inches

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-13 (Hole #) | 4/17/24 (Date) | 11:45AM (Time) | Clear, 55 (Weather) | 42.4' N (Latitude) | 71.2' W (Longitude)

1. Land Use: Wooded lot in residential area (e.g., woodland, agricultural field, vacant lot, etc.) | Trees (Vegetation) | Some surface stones, not many (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 1% (Slope (%))

Description of Location: Southeast corner of infiltration system; about 135' from Dorothy Road

2. Soil Parent Material: Glaciofluvial deposits | Depression (Landform) | TS (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body >100 feet | Drainage Way >100 feet | Wetlands 180 feet

Property Line 130 feet | Drinking Water Well >100 feet | Other ____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 57" Depth to Weeping in Hole 67" Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-74	Fill	Sandy Loam	7.5YR 3/2		Cnc : Dpl:	5-10	0	10-20	Massive	Friable	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one): Obs. Hole # TP-13 Obs. Hole # _____

☐ Depth to soil redoximorphic features _____ inches _____ inches

☒ Depth to observed standing water in observation hole 57 inches _____ inches

☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology) _____ inches _____ inches

_____________ Index Well Number _____________ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

☐ Yes ☒ No

b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

c. If no, at what depth was impervious material observed? Upper boundary: 57 inches Lower boundary: 74 inches

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

[signature]	4/17/2024
Signature of Soil Evaluator	Date
Emily Derrig, SE 14158	6/30/2026
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License
Name of Approving Authority Witness	Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:

APPENDIX E

NOAA 14++ PRECIPITATION TABLES

NOAA Atlas 14, Volume 10, Version 3
Location name: Arlington, Massachusetts, USA*
Latitude: 42.4008°, Longitude: -71.1485°
Elevation: 5 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.303 (0.237-0.383)	0.372 (0.290-0.471)	0.484 (0.377-0.617)	0.578 (0.447-0.739)	0.706 (0.530-0.954)	0.802 (0.590-1.11)	0.905 (0.649-1.31)	1.03 (0.691-1.52)	1.21 (0.784-1.86)	1.36 (0.864-2.14)
10-min	0.429 (0.335-0.543)	0.527 (0.411-0.668)	0.687 (0.535-0.874)	0.819 (0.633-1.05)	1.00 (0.751-1.35)	1.14 (0.837-1.58)	1.28 (0.919-1.86)	1.46 (0.979-2.15)	1.71 (1.11-2.63)	1.93 (1.22-3.03)
15-min	0.505 (0.395-0.639)	0.620 (0.484-0.785)	0.808 (0.628-1.03)	0.963 (0.745-1.23)	1.18 (0.884-1.59)	1.34 (0.983-1.85)	1.51 (1.08-2.18)	1.71 (1.15-2.52)	2.02 (1.31-3.09)	2.28 (1.44-3.56)
30-min	0.690 (0.540-0.874)	0.849 (0.663-1.08)	1.11 (0.862-1.41)	1.32 (1.02-1.70)	1.62 (1.22-2.19)	1.84 (1.36-2.55)	2.08 (1.49-3.02)	2.36 (1.59-3.48)	2.80 (1.81-4.29)	3.17 (2.01-4.96)
60-min	0.876 (0.685-1.11)	1.08 (0.842-1.37)	1.41 (1.10-1.79)	1.68 (1.30-2.16)	2.06 (1.55-2.79)	2.34 (1.73-3.25)	2.64 (1.90-3.85)	3.01 (2.03-4.44)	3.58 (2.32-5.49)	4.06 (2.57-6.37)
2-hr	1.14 (0.896-1.43)	1.40 (1.10-1.77)	1.84 (1.44-2.32)	2.20 (1.71-2.79)	2.69 (2.04-3.62)	3.06 (2.27-4.22)	3.46 (2.51-5.01)	3.96 (2.67-5.79)	4.74 (3.08-7.21)	5.43 (3.45-8.42)
3-hr	1.33 (1.05-1.66)	1.63 (1.29-2.05)	2.14 (1.68-2.69)	2.56 (2.00-3.24)	3.13 (2.38-4.20)	3.55 (2.65-4.90)	4.02 (2.93-5.81)	4.61 (3.12-6.70)	5.54 (3.60-8.36)	6.35 (4.04-9.79)
6-hr	1.72 (1.37-2.14)	2.11 (1.68-2.63)	2.76 (2.18-3.44)	3.29 (2.59-4.14)	4.02 (3.07-5.34)	4.56 (3.42-6.22)	5.15 (3.77-7.37)	5.90 (4.01-8.50)	7.06 (4.61-10.6)	8.08 (5.16-12.3)
12-hr	2.20 (1.76-2.71)	2.69 (2.15-3.33)	3.50 (2.79-4.34)	4.17 (3.31-5.21)	5.10 (3.92-6.71)	5.78 (4.35-7.80)	6.52 (4.79-9.21)	7.44 (5.08-10.6)	8.85 (5.80-13.1)	10.1 (6.45-15.2)
24-hr	2.64 (2.13-3.24)	3.27 (2.64-4.02)	4.31 (3.46-5.31)	5.16 (4.12-6.40)	6.34 (4.91-8.30)	7.21 (5.47-9.67)	8.16 (6.03-11.5)	9.35 (6.41-13.2)	11.2 (7.36-16.4)	12.8 (8.22-19.1)
2-day	3.01 (2.45-3.67)	3.80 (3.09-4.64)	5.10 (4.13-6.24)	6.18 (4.97-7.61)	7.66 (5.97-9.97)	8.74 (6.69-11.7)	9.94 (7.43-13.9)	11.5 (7.91-16.1)	14.0 (9.23-20.3)	16.2 (10.4-23.9)
3-day	3.30 (2.70-4.01)	4.16 (3.39-5.05)	5.56 (4.52-6.78)	6.72 (5.43-8.24)	8.32 (6.52-10.8)	9.48 (7.29-12.6)	10.8 (8.09-15.1)	12.5 (8.60-17.4)	15.2 (10.1-21.9)	17.7 (11.4-25.9)
4-day	3.58 (2.93-4.33)	4.46 (3.65-5.41)	5.91 (4.82-7.18)	7.11 (5.76-8.69)	8.76 (6.88-11.3)	9.96 (7.68-13.2)	11.3 (8.51-15.7)	13.1 (9.02-18.1)	15.9 (10.5-22.8)	18.4 (11.9-26.9)
7-day	4.34 (3.58-5.23)	5.26 (4.33-6.34)	6.77 (5.55-8.18)	8.02 (6.53-9.74)	9.74 (7.68-12.5)	11.0 (8.50-14.4)	12.4 (9.33-17.0)	14.2 (9.85-19.5)	17.1 (11.4-24.3)	19.7 (12.7-28.5)
10-day	5.04 (4.17-6.05)	5.99 (4.95-7.19)	7.54 (6.20-9.07)	8.82 (7.21-10.7)	10.6 (8.37-13.5)	11.9 (9.20-15.5)	13.3 (10.0-18.1)	15.1 (10.5-20.7)	18.0 (12.0-25.4)	20.5 (13.3-29.5)
20-day	7.05 (5.88-8.40)	8.08 (6.73-9.63)	9.76 (8.09-11.7)	11.2 (9.19-13.4)	13.1 (10.4-16.4)	14.5 (11.2-18.6)	16.0 (12.0-21.2)	17.8 (12.5-24.0)	20.3 (13.6-28.4)	22.4 (14.6-32.0)
30-day	8.72 (7.30-10.3)	9.81 (8.20-11.6)	11.6 (9.65-13.8)	13.1 (10.8-15.6)	15.1 (12.0-18.7)	16.7 (12.9-21.1)	18.3 (13.6-23.8)	19.9 (14.0-26.8)	22.2 (14.9-30.9)	24.0 (15.7-34.0)
45-day	10.8 (9.08-12.7)	12.0 (10.0-14.1)	13.9 (11.6-16.4)	15.4 (12.8-18.4)	17.6 (14.0-21.6)	19.3 (14.9-24.1)	20.9 (15.5-26.9)	22.6 (15.9-30.1)	24.6 (16.6-33.9)	26.2 (17.1-36.8)
60-day	12.6 (10.6-14.8)	13.8 (11.6-16.2)	15.8 (13.2-18.6)	17.4 (14.5-20.7)	19.7 (15.7-24.0)	21.4 (16.6-26.7)	23.1 (17.1-29.5)	24.7 (17.5-32.8)	26.7 (18.0-36.6)	28.0 (18.3-39.2)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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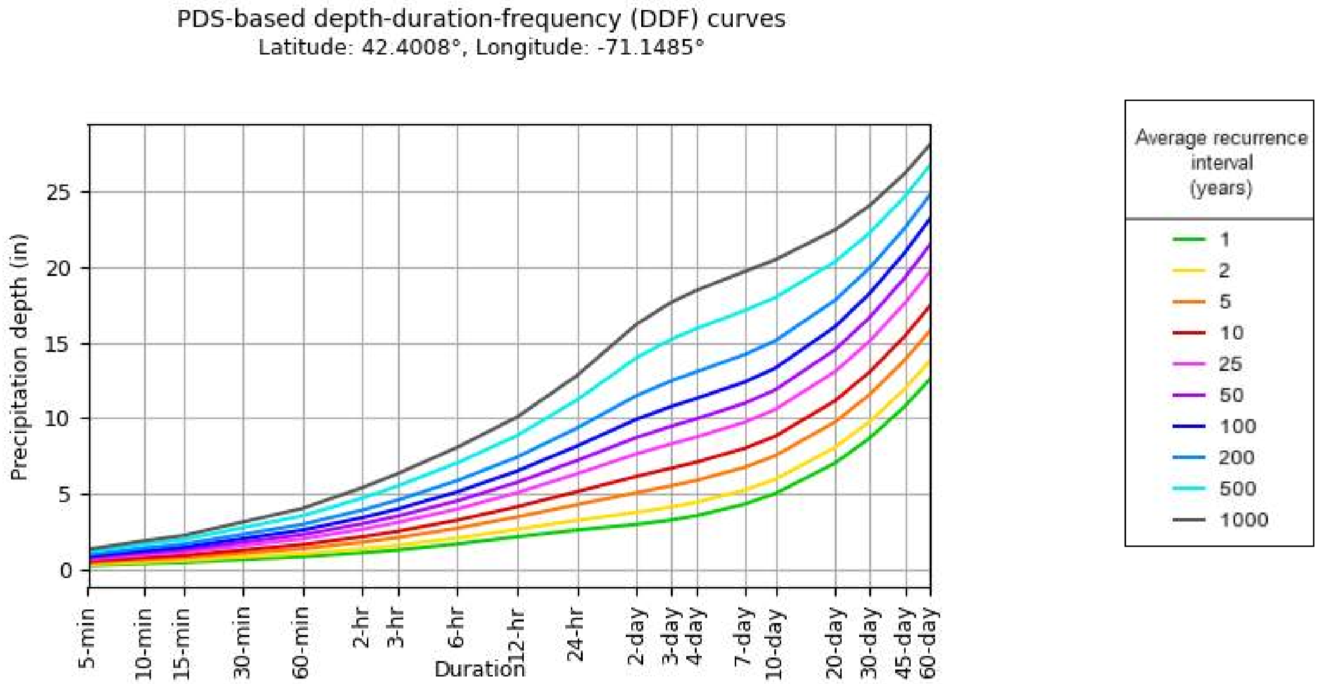
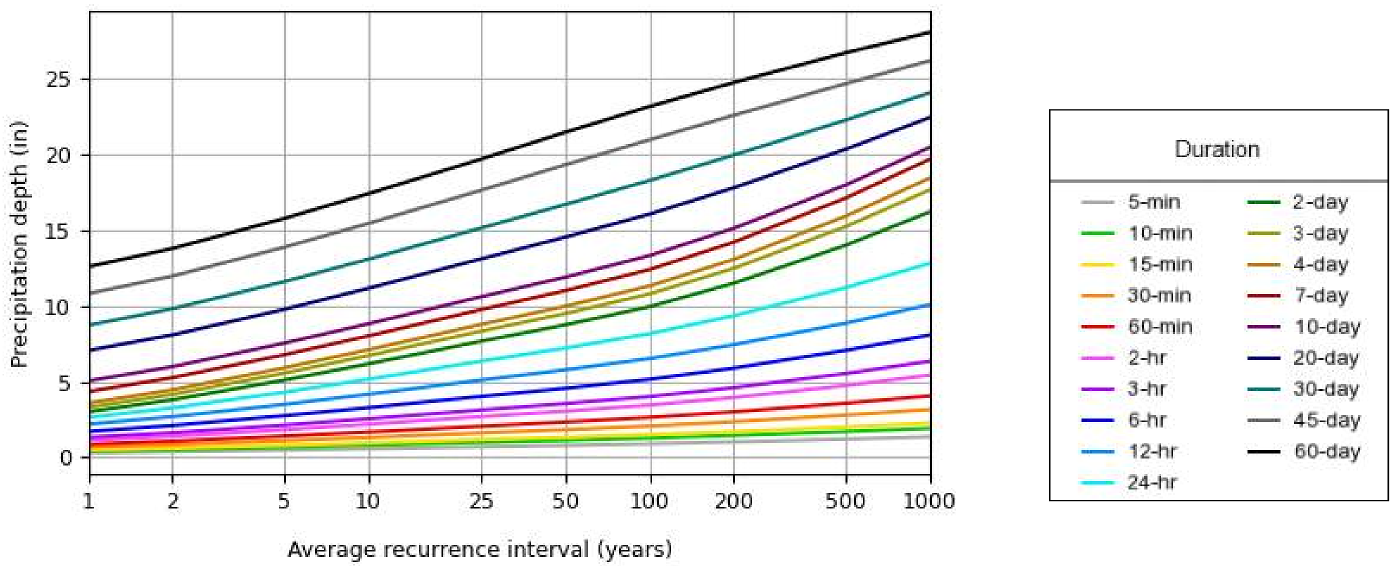
PF graphical





NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Fri Aug 11 18:14:24 2023

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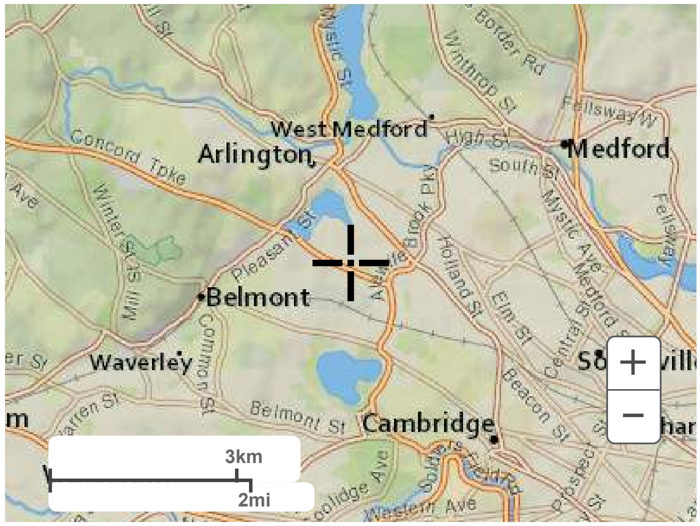
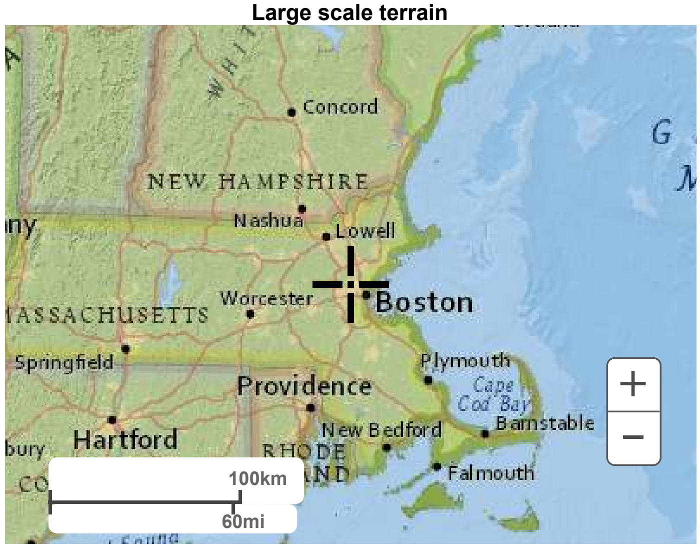
Maps & aerials

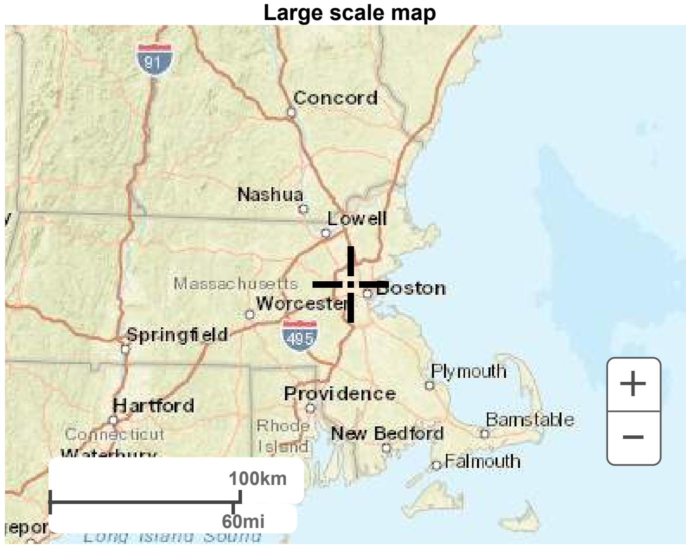
Small scale terrain



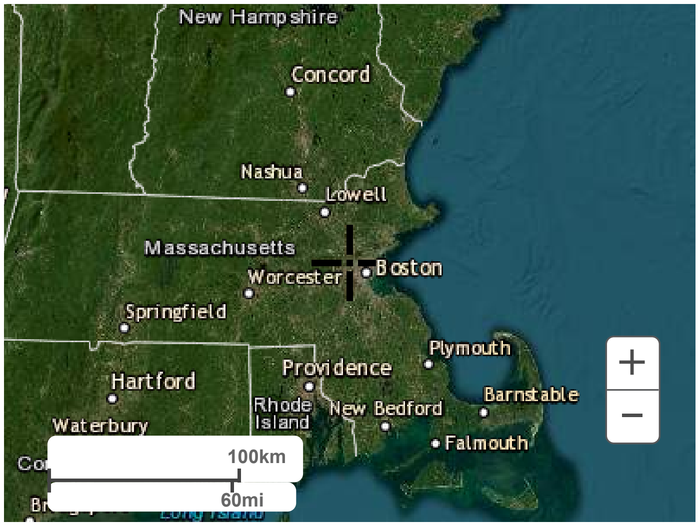
Large scale terrain



Large scale map



Large scale aerial



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APPENDIX F

STORMWATER CHECKLIST

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

---

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☒ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of “country drainage” versus curb and gutter conveyance and pipe
- ☒ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): ____________

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☒ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist (continued)

Standard 3: Recharge (continued)

☒ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☒ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:
- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

  ☐ is within the Zone II or Interim Wellhead Protection Area

  ☐ is near or to other critical areas

  ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)

  ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☒ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

APPENDIX G

MCPHAIL GEOTECHNICAL MEMORANDUM

Memorandum

Date:	December 9, 2024
Recipient:	Arlington Land Manager LLC c/o Dinosaur Capital Partners LLC – Scott Oran
Sender:	Scott S. Smith, P.E.
Project:	Thorndike Place; Arlington, MA
Project No:	7679.2.01
Subject:	Subsurface Conditions at Proposed Stormwater Infiltration System

Background

This memorandum documents the subsurface soil and groundwater conditions encountered in the borings performed at the Thorndike Place project site during November 2024. The purpose of the borings was to provide supplemental information to the project civil engineer related to stormwater infiltration system design, including the saturated soil thickness within the footprint of the proposed stormwater infiltration system.

The 5.8-acre subject property is bounded by Dorothy Road and residences to the north, residences and undeveloped conservation land to the east, undeveloped conservation land to the south and the Concord Turnpike (Route 2) to the west. The subject property is currently unoccupied, undeveloped wooded land. Refer to the Project Location Plan, **Figure 1**, for the general site locus.

Based on the information provided to us, the proposed development is planned to consist of six (6), 3-story townhouses with footprints of about 1,700 square feet that are planned to include basements, and a 4-story multi-family residential building with a footprint of about 33,000 square feet that is planned to have 1-level of below-grade parking.

It is understood that as part of the proposed development, a stormwater infiltration system with a footprint of about 8,100 square feet will be constructed within the western portion of the site.

Elevations cited herein are in feet and are referenced to the North American Vertical Datum of 1988 (NAVD88).

Subsurface Explorations

The approximate locations of the subsurface explorations are indicated on the enclosed Subsurface Exploration Plan, **Figure 2**. The following subsurface explorations were completed at the project site under contract to McPhail:

GEOTECHNICAL AND GEOENVIRONMENTAL ENGINEERS
42 3rd Avenue
Burlington, MA 01803
(617) 868-1420

- Two (2) borings (MA-1 through MA-2) were completed on November 20, 2024 by Carr-Dee Corp. of Medford, Massachusetts.

The borings were drilled to depths ranging from 37 to 42 feet below the existing ground surface and were terminated within a natural marine clay deposit. The boring logs are attached to this memorandum.

Thirteen (13) test pits were previously excavated at the site by others during May 2023 and April 2024. Additionally, four (4) groundwater monitoring wells were installed within completed test pits TP-1, TP-6, TP-7, and TP-9.

Soil Conditions

A detailed description of the subsurface conditions encountered in the explorations is documented on the boring logs attached to this memorandum. The approximate locations of the subsurface explorations are indicated on the enclosed Subsurface Exploration Plan, **Figure 2**.

Based on the results of the borings performed at the site, the following is a description of the generalized subsurface conditions encountered from ground surface downward.

Generalized Subsurface Strata	***Approximate Thickness (Feet)***	***Top of Soil Strata (Elevation)***
Fill	5.5 to 9.5	El. +7.9 to El. +11.1 (Ground Surface)
Peat	2.5 (At boring MA-2 only)	El. +2.4
Alluvium	12 to 19	El. -0.1 to El. +1.6
Marine Clay	Not Penetrated	El. -17.4 to El. -12.1

Fill Material: The fill material generally consists of compact to dense sand and gravel, trace to some silt, varying to a silt and sand, trace gravel and containing brick, wood, ash and cinders.

Organic Deposit: Underlying the fill at boring MA-2, the organic deposit generally consists of soft to firm, brown fibrous peat. The organic deposit was not encountered in boring MA-1 and appears to be discontinuous between MA-1 and MA-2.

Alluvium Deposit: Underlying the fill at boring MA-1 and the organic deposit at boring MA-2, the alluvium deposit generally consists of a compact to dense gray-brown stratified silty sand, varying to sand, trace silt.

Marine Clay Deposit: Underlying the alluvium deposit, the marine clay deposit generally consists of a very soft to stiff, gray silty marine clay deposit with occasional to frequent sand lenses of varying thickness. At boring MA-2, an approximate 2.5-foot-thick sand seam was observed from about Elevation -13.1 to Elevation -15.6. The depth to the top of the marine clay deposit was observed at about 28.5 feet and 20 feet below the existing ground surface at MA-1 and MA-2, respectively. The borings were terminated within the marine clay deposit which is anticipated to extend to depths greater than 100 feet below the existing ground surface and be underlain by glacial till and bedrock.

Groundwater Conditions

Where encountered in the borings during drilling, groundwater was observed at depths ranging from about 12 and 11 feet below the existing ground surface at boring MA-1 and MA-2, corresponding to Elevation -0.9 and Elevation -3.1, respectively.

It is anticipated that future groundwater levels across the site may vary from those reported herein due to factors such as normal seasonal changes, runoff particularly during or following periods of heavy precipitation, and alterations of existing drainage patterns.

Summary and Conclusions

The subsurface soil conditions in borings MA-1 and MA-2 consisted of a granular fill material, underlain by a discontinuous peat deposit, underlain by an alluvium deposit, overlying a marine clay deposit. The depth to the top of the marine clay deposit was observed at about 28.5 feet and 20 feet below the existing ground surface, corresponding to Elevation -17.4 and Elevation -12.1 at MA-1 and MA-2, respectively. The marine clay deposit is anticipated to have a low permeability and would be considered a barrier to groundwater flow, typically signifying the bottom of the permeable soils.

Closing

We trust that the above is sufficient for your present requirements. Should you have any questions concerning the recommendations presented herein, please do not hesitate to contact us.

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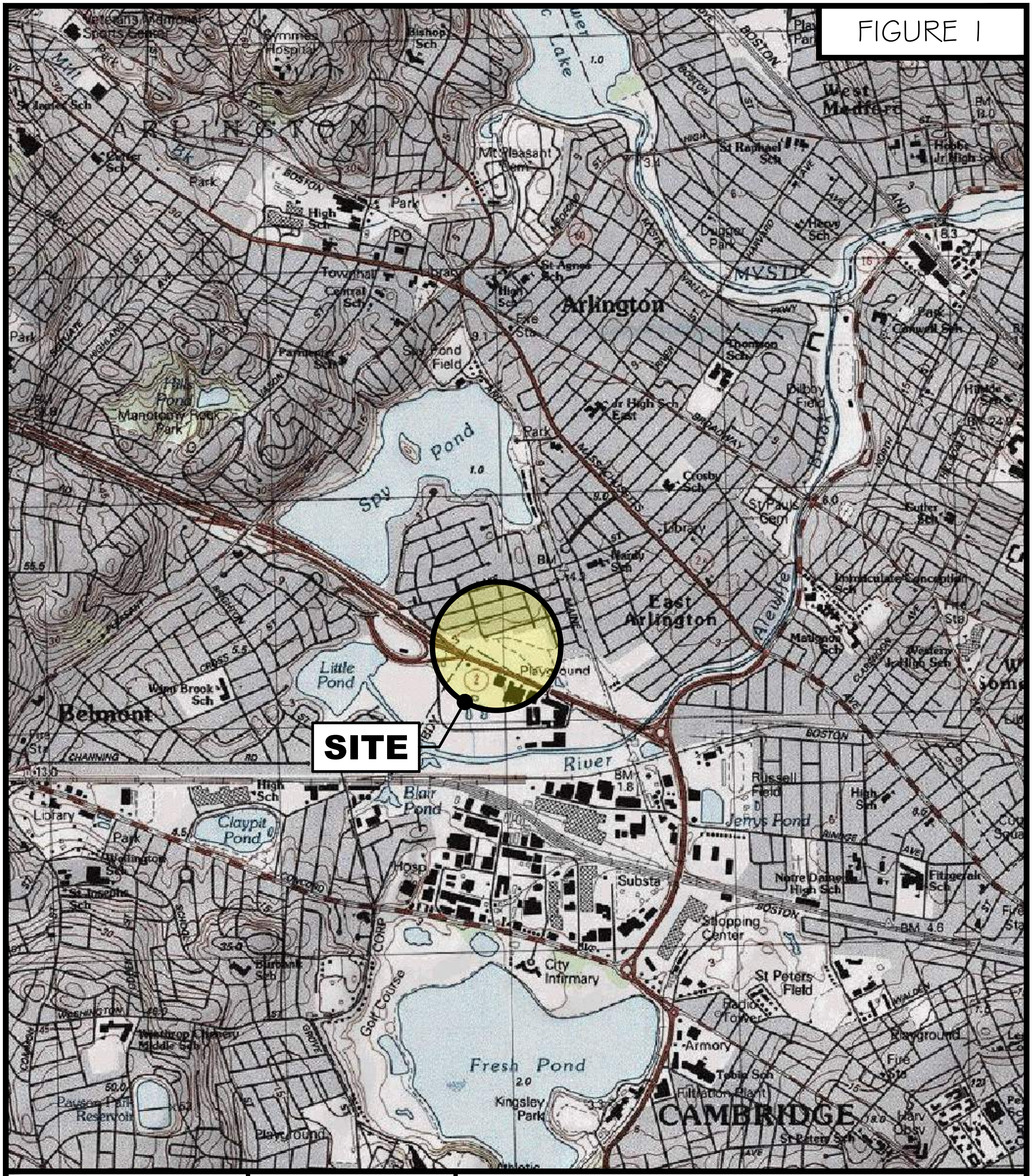
SSS/ada

Attachments: Figure 1: Project Location Plan
Figure 2: Subsurface Exploration Plan
Boring Logs



McPHAIL ASSOCIATES, LLC

42 3rd Avenue
Burlington, MA 01803
617-868-1420
www.mcphailgeo.com

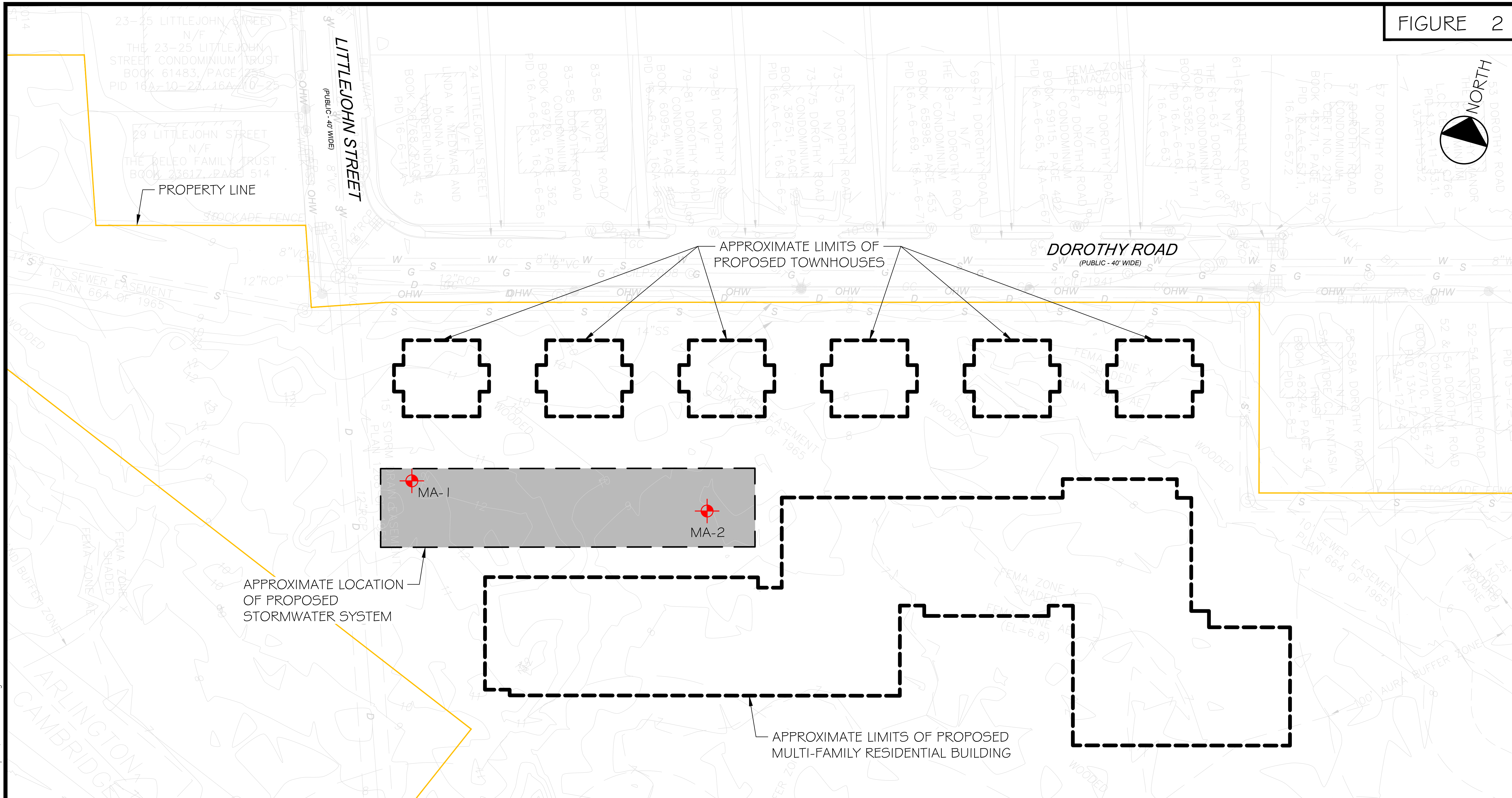
N

SCALE 1:25,000

PROJECT LOCATION PLAN

THORNDIKE PLACE

ARLINGTON MASSACHUSETTS



LEGEND

— APPROXIMATE LOCATION OF BOREHOLE PERFORMED BY CARR-DEE CORP. ON NOVEMBER 20, 2024 FOR McPHAIL ASSOCIATES, LLC

REFERENCE: THIS PLAN WAS PREPARED FROM AN 80-SCALE DRAWING ENTITLED "EXISTING CONDITIONS" DATED SEPTEMBER 6, 2023 BY BSC GROUP, INC.

GRAPHIC SCALE

50 0 50 100

FILE NAME: N:\Acad\JOBS\7679\Geotech Data Report\7679-F02.dwg

McPHAIL ASSOCIATES, LLC
42 3rd Avenue
Burlington, MA 01803
617-868-1420
www.mcphailgeo.com

THORNDIKE PLACE

ARLINGTON MASSACHUSETTS

SUBSURFACE EXPLORATION PLAN

FOR

DINOSAUR CAPITAL PARTNERS LLC

BY

McPHAIL ASSOCIATES, LLC

Date: DECEMBER 2024	Dwn: I.J.M.	Chkd: S.S.S.	Scale: 1" = 50'
Project No: 7679			

Project:	Thorndike Place	**Job #:**	7679.2.01
Location:	See Plan	**Date Started:**	11-20-24
City/State:	Arlington, Massachusetts	**Date Finished:**	11-20-24

Boring No. MA-1

Contractor:	Carr-Dee Corp	**Casing Type/Depth (ft):**	2.25" I.D. HSA/NW Casing
Driller/Helper:	J. DeSimone/C. Smith	**Casing Hammer (lbs)/Drop (in):**	300 lbs./24 inches
Logged By/Reviewed By:	T. M. Cormican	**Sampler Size/Type:**	1-3/8" I.D. Split Spoon
Surface Elevation (ft):	11.1	**Sampler Hammer (lbs)/Drop (in):**	140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
11-20-24	12	-0.9	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	N-Value	No.	Pen. /Rec. (in)	Depth (ft)	Blows Per 6"	Sample Description and Boring Notes
0-2	11.1-9			FILL	12	S-1	24/8	0.0-2.0	3 5 7 12	Compact light brown silty SAND and GRAVEL. (FILL)
5-7	6-4			FILL	70	S-2	24/16	5.0-7.0	14 37 33 49	Very dense, gray-brown SAND and GRAVEL, trace to some silt to BRICK. (FILL)
9.5	1.6		9.5 / 1.6							
10-12	1 to -1			ALLUVIUM DEPOSIT	19	S-3	24/0	10.0-12.0	16 12 7 14	No Recovery
12-14	-1 to -3			ALLUVIUM DEPOSIT	45	S-4	24/14	12.0-14.0	14 23 22 20	Dense, dark gray SAND, trace to some silt. (ALLUVIUM DEPOSIT)
15-17	-4 to -6			ALLUVIUM DEPOSIT	23	S-5	24/12	15.0-17.0	9 12 11 12	Compact, gray-brown SAND, trace silt. (ALLUVIUM DEPOSIT)
20-22	-9 to -11			ALLUVIUM DEPOSIT	17	S-6	24/18	20.0-22.0	8 8 9 12	Compact, orange-brown and yellow-brown stratified silty SAND to SAND, trace silt. (ALLUVIUM DEPOSIT)

GRANULAR SOILS

BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS

BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
1. Used Automatic Hammer for SPT.
2. Drillers switched to casing after obtaining sample from 12-14'.

Weather: Variable

McPHAIL ASSOCIATES, LLC
42 3rd AVENUE
Burlington, MA 01803
TEL: 617-868-1420
FAX: 617-868-1423

Project: Thorndike Place	**Job #:** 7679.2.01		Boring No. **MA-1**
Location: See Plan	**Date Started:** 11-20-24		
City/State: Arlington, Massachusetts	**Date Finished:** 11-20-24		

Contractor: Carr-Dee Corp
Driller/Helper: J. DeSimone/C. Smith
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): 11.1
Casing Type/Depth (ft): 2.25" I.D. HSA/NW Casing
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
11-20-24	12	-0.9	

Depth (ft)	Elev. (ft)	Depth/EL to Strata Change (ft)	Stratum	N-Value	No.	Pen. /Rec. (in)	Depth (ft)	Blows Per 6"	Sample Description and Boring Notes
24	-13		ALLUVIUM DEPOSIT						
25	-14			33	S-7	24/18	25.0-27.0	19 17 16 15	Dense, gray stratified silty SAND to SAND, trace silt. (ALLUVIUM DEPOSIT)
26	-15								
27	-16								
28	-17	28.5 / -17.4							
29	-18		MARINE CLAY						
30	-19			9	S-8	24/18	30.0-32.0	3 4 5 3	Stiff, gray silty CLAY with ~ 6 inch layer of sand. (MARINE CLAY)
31	-20								
32	-21								
33	-22								
34	-23								
35	-24			1/24"	S-9	24/22	35.0-37.0	1/24"	Very soft, gray silty CLAY. (MARINE CLAY)
36	-25	37.0 / -25.9							
37	-26		Bottom of Borehole at 37.0 feet below existing grade.						
38	-27								
39	-28								
40	-29								
41	-30								
42	-31								
43	-32								
44	-33								
45	-34								

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
1. Used Automatic Hammer for SPT.
2. Drillers switched to casing after obtaining sample from 12-14'.

Weather: Variable

McPHAIL ASSOCIATES, LLC
42 3rd AVENUE
Burlington, MA 01803
TEL: 617-868-1420
FAX: 617-868-1423

Project: Thorndike Place	**Job #:** 7679.2.01	Boring No.
Location: See Plan	**Date Started:** 11-20-24	**MA-2**
City/State: Arlington, Massachusetts	**Date Finished:** 11-20-24	

Contractor: Carr-Dee Corp
Driller/Helper: J. DeSimone/C. Smith
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): 7.9

Casing Type/Depth (ft): 2.25" I.D. HSA/NW Casing
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
11-20-24	11	-3.1	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value	Sample No.	Sample Pen. /Rec. (in)	Sample Depth (ft)	Sample Blows Per 6"	Sample Description and Boring Notes
			0.4 / 7.5	TOPSOIL						
1	7			FILL	4	S-1	24/16	0.0-2.0	3 2 2 3	Very loose to loose, mottled gray-brown SILT and SAND, trace gravel. (FILL)
2	6									
3	5									
4	4									
5	3		5.5 / 2.4		4	S-2	6/6	5.0-5.5	2	Very loose, mottled orange-brown and black SILT and SAND, with wood, ash and cinders. (FILL)
6	2			ORGANIC DEPOSIT	4	S-2a	18/18	5.5-7.0	2 2 2	Soft to firm, brown FIBROUS PEAT. (ORGANIC DEPOSIT)
7	1									
8	0		8.0 / -0.1							
9	-1			ALLUVIUM DEPOSIT						
10	-2				17	S-3	24/14	10.0-12.0	9 8 9 9	Compact, gray-brown stratified silty SAND to SAND, trace silt. (ALLUVIUM DEOSIT)
11	-3									
12	-4									
13	-5									
14	-6									
15	-7				18	S-4	24/16	15.0-17.0	8 8 10 9	Compact, stratified gray silty SAND to SAND, trace silt. (ALLUVIUM DEPOSIT)
16	-8									
17	-9									
18	-10									
19	-11									
20	-12		20.0 / -12.1	MARINE CLAY	5	S-5	12/12	20.0-21.0	3 2	Very soft to soft, gray silty CLAY with silt and sand seams. (MARINE CLAY)
21	-13		21.0 / -13.1	MARINE SAND	22	S-5a	12/12	21.0-22.0	8 14	Compact, gray stratified silty SAND to SAND, trace silt. (MARINE SAND)
22	-14									

GRANULAR SOILS

BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS

BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
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Notes:
1. Used Automatic Hammer for SPT.
2. Drillers switched to casing after obtaining sample from 10-12'.

Weather: Variable

McPHAIL ASSOCIATES, LLC
42 3rd AVENUE
Burlington, MA 01803
TEL: 617-868-1420
FAX: 617-868-1423

Project: Thorndike Place	**Job #:** 7679.2.01		Boring No.
Location: See Plan	**Date Started:** 11-20-24		**MA-2**
City/State: Arlington, Massachusetts	**Date Finished:** 11-20-24		

Contractor: Carr-Dee Corp
Driller/Helper: J. DeSimone/C. Smith
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): 7.9

Casing Type/Depth (ft): 2.25" I.D. HSA/NW Casing
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
11-20-24	11	-3.1	

Depth (ft)	Elev. (ft)	Depth/EL to Strata Change (ft)	Stratum	N-Value	No.	Pen. /Rec. (in)	Depth (ft)	Blows Per 6"	Sample Description and Boring Notes
		23.5 / -15.6	MARINE SAND						
24	-16								
25	-17			2	S-6	24/24	25.0-27.0	1/12' 1 1	Very soft, gray silty CLAY with frequent sand partings in bottom ~ 10 inches of sample. (MARINE CLAY)
26	-18								
27	-19								
28	-20								
29	-21								
30	-22			1	S-7	24/24	30.0-32.0	WOH WOH 1 1	Very soft, gray silty CLAY with frequent sand partings. (MARINE CLAY)
31	-23								
32	-24								
33	-25		MARINE CLAY						
34	-26								
35	-27			1	S-8	24/24	35.0-37.0	WOH WOH 1 1	Very soft, gray silty CLAY, with occasional sand partings. (MARINE CLAY)
36	-28								
37	-29								
38	-30								
39	-31								
40	-32			1	S-9	24/24	40.0-42.0	WOH WOH 1 WOH	Very soft, gray silty CLAY, with occasional sand partings. (MARINE CLAY)
41	-33								
42	-34	42.0 / -34.1	Bottom of Borehole at 42.0 feet below existing grade.						
43	-35								
44	-36								
45	-37								

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
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Notes:
1. Used Automatic Hammer for SPT.
2. Drillers switched to casing after obtaining sample from 10-12'.

Weather: Variable

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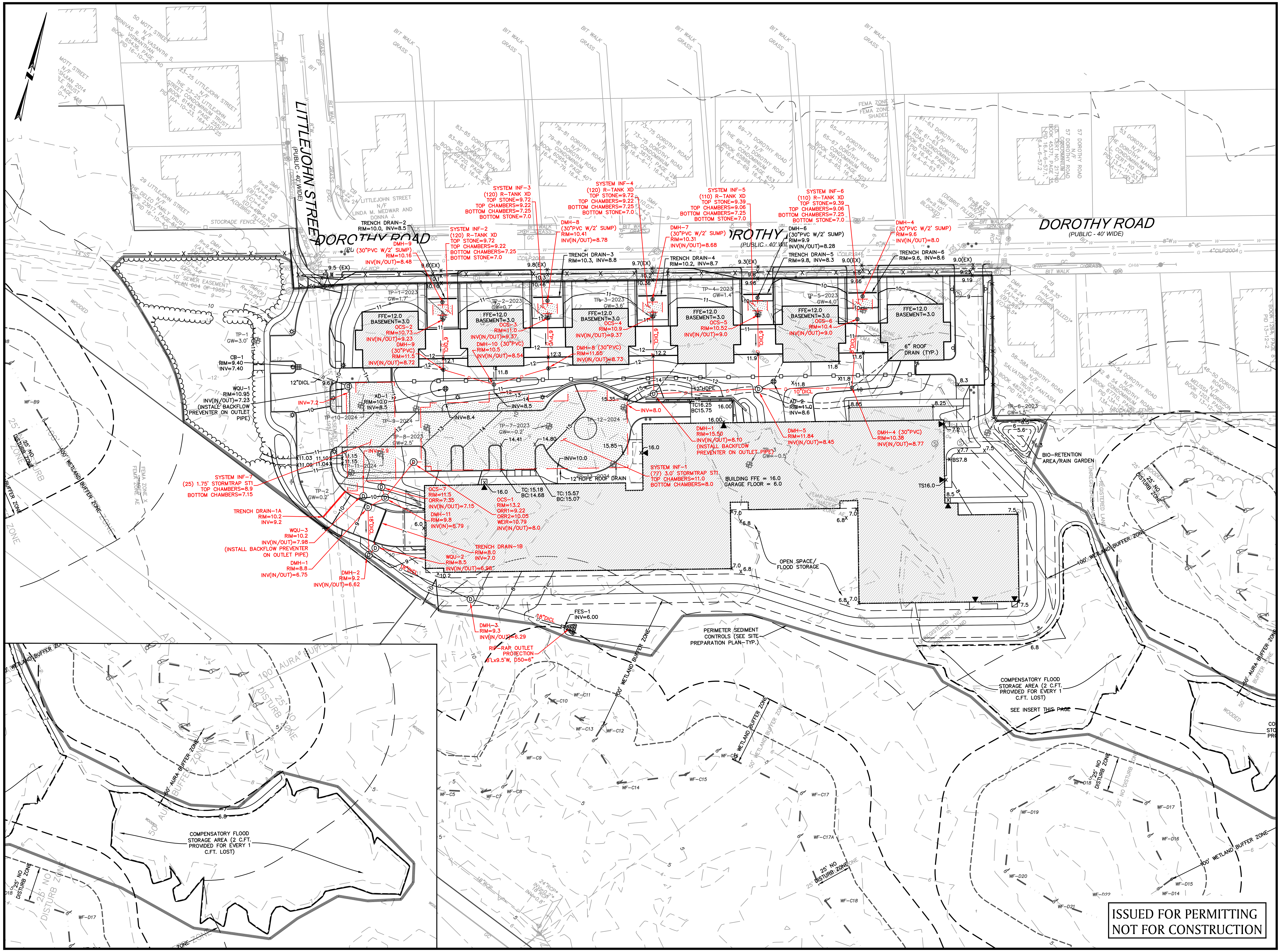
42 3rd AVENUE
Burlington, MA 01803
TEL: 617-868-1420
FAX: 617-868-1423

Revisions to Stormwater Management Design
December 2024

The following attachments are only the portions of the Stormwater Report for Thorndike Place that have been revised in December 2024. This information is all included in the full Stormwater Report but is being provided in this format to help simplify review.



PROFESSIONAL ENGINEER

THORNDIKE PLACE
NOTICE OF INTENT

DOROTHY ROAD

IN

ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

GRADING & DRAINAGE PLAN

SEPTEMBER 6, 2023

REVISIONS:

NO.	DATE	DESC.
1	9/12/24	INFILTRATION SYSTEM
2	12/10/24	PEER REVIEW REVISIONS

PREPARED FOR:

ARLINGTON LAND REALTY, LLC
84 SHERMAN STREET, 2ND FLOOR
CAMBRIDGE, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

SCALE: 1" = 30'

0 15 30 60 FEET

FILE: 2340702\C\D\2340702-GR

DWG.:

JOB. NO: 23407.02

SHEET C-104

1.01 PROJECT DESCRIPTION

Arlington Land Realty, LLC (The Applicant) is seeking to construct a new age restricted multi-family housing development in Arlington, Massachusetts, hereinafter referred to as "the Project." The total property area is approximately 17.66 acres and is located off Dorothy Road near the intersection with Littlejohn Street. The project is bounded on the north by Dorothy Road, on the east by residential properties and Thorndike Field, and bounded on the south and west by Concord Turnpike (Route 2).

The Project consists of clearing and grubbing of the northwest section of the property and construction of one 4-story senior living residential building with a lower-level parking garage, six duplex townhouses with covered carports, as well as surface parking, walkways, utility services, and a stormwater management system. The buildings have a combined footprint of approximately 46,100 square feet.

The Project is designed to comply with the Massachusetts General Laws (M.G.L.) Chapter 40B, which allows developers to override certain aspects of municipal zoning bylaws by providing a certain percentage of affordable housing, as well as the Department of Environmental Protection's Stormwater Management Standards. There are wetland resource areas in the south, west and east portions of the property. The Project is concentrated in the northwest area of the property and minimizes impacts to the 100-foot wetland buffer zones. Part of the site is located within the 1% Chance Annual Flood as defined by FEMA which is regulated under the Wetlands Protection Act as Bordering Land Subject to Flooding (BLSF). Compensatory flood storage is proved at a 2:1 ratio as described in section 2.12 below. This Stormwater Report and design were extensively peer reviewed in November 2020 and August 2021 by BETA Group during the Comprehensive Permit Application process and again by both Hatch Associates Consultants, Inc. and GZA GeoEnvironmental, Inc. during the Conservation Commission's review of the Project's Notice of Intent.

1.02 PRE-DEVELOPMENT CONDITIONS

The existing site topography generally slopes southeast across the property towards the wetlands located on the property with slopes ranging from 0-15%. The current site is comprised of forest and the primary soil classification identified by the NRCS Web Soil Survey is udorthents (655), which accounts for the majority of the property and all of the project area. On November 25, 2020, BSC Group conducted three test pits on the site, the locations of which are noted on the Grading and Drainage plan, and the test pit logs attached in Appendix D. The test pits consisted primarily of fill material to a depth of 9-11 feet generally conforming with the soils mapping. Even though the material was fill, all samples textured as sandy loam in test pits TP-1 and TP-2, closest to the proposed stormwater management systems. At the bottom of test pit TP-3, a layer of clay material was found. Based on the fill materials found, runoff calculations have been performed using curve numbers corresponding to Hydrologic Soil Group (HSG) C.

Due to changes to the site design over the course of the Comprehensive Permit process, the proposed infiltration systems were relocated. As such, and to comply with Conditions C.2(k) and I.17 of the Comprehensive Permit that was issued by the Arlington Zoning Board of Appeals for the project in 2021, BSC conducted 8 additional soil test pits on May 18 and 19, 2023. The soil types for these test pits generally consisted of fill materials overlaying fine sandy loam, consistent with the previous test pits conducted in 2020. In accordance with the Comprehensive Permit conditions, BSC coordinated with the Town of Arlington to ensure that Town staff or a representative designated by the Town would be on site during test pit work to witness and confirm the results. BSC contacted Claire Ricker, Director of Planning & Community Development to coordinate a test pit witness for the Town and was referred through Town Engineer, Wayne Chouinard to David Morgan, Environmental Planner and Conservation Agent. Mr. Morgan arranged to have a representative from Whitestone Associates on site to witness the test pits on May 18 and 19, 2023. These test pit locations have been added to the revised Grading and Drainage plan and the additional test pit logs are included in Appendix D.

Five more test pits were conducted on April 17, 2024, to gather additional soil and groundwater data and confirm that the design of the infiltration system would meet the Stormwater Standards per the DEP's Massachusetts Stormwater Handbook. These test pits were consistent with the others that were conducted previously and consisted mainly of fill

that textured as sandy loam. One test pit, TP-9, found parent material 100-inches down, which was also a fine sandy loam. Additional test pit logs are included in Appendix D.

In November 2024, McPhail Associates, LLC (McPhail) performed two (2) soil borings on the Project site in the areas of proposed Infiltration Systems 1 and 7. These soil borings were performed to better understand the depth to a restrictive layer to more accurately determine the initial saturated thickness to be used in groundwater mounding analyses for the Project. A memorandum documenting this work is included in Appendix G. The borings showed a marine clay layer with a highest elevation between -12.1 and -17.4. Based on this additional data, all groundwater mounding analyses have been performed using an initial saturated thickness of 16-feet representing the depth between ESHGW (4.0) and the marine clay layer (-12.1).

The existing site being largely undeveloped has no existing drainage facilities and the majority of the stormwater runoff is directed to the wetlands on the property. A small portion of the site discharges to the north to Dorothy Road.

1.03 Post-Development Conditions

The proposed stormwater management system has been designed in a manner that will meet or exceed the provisions of the Department of Environmental Protection (DEP) Stormwater Management Standards for a new construction project.

Stormwater runoff from the site driveway and small parking/drop-off area at the main entrance to the building will be collected via a deep sump catch basin, conveyed through a water quality unit before being directed to an underground infiltration system. Stormwater runoff from a portion the driveway into the garage below the building will be collected via a trench drain and conveyed through a water quality unit before being directed to the underground system. Due to its elevation difference, this leg of the system has been provided with a backflow preventer device. This underground infiltration system provides for recharge to groundwater and provides peak flow rate attenuation. In larger storm events, this system will overflow through an outlet control structure to a flared end section with a rip-rap apron to the south.

Runoff from the townhouse and carport roofs, as well as the landscaped areas between the townhouses and 4-story building will be collected and routed to a second underground infiltration area. This underground infiltration area will also collect runoff from the roof of the 4-story building. This underground infiltration system provides for recharge to groundwater and provides peak flow rate attenuation. In larger storm events, this system will overflow through an outlet control structure to a flared end section with a rip-rap apron to the south.

Stormwater runoff from the townhouse driveways along Dorothy Rd will be collected via individual trench drains and routed to small underground infiltration chamber systems beneath each driveway. These systems provide localized infiltration to groundwater and help meet the required recharge volume for the Project. Overflow from these systems will be routed to the same infiltration system as the townhouse roofs and 4-story building.

Runoff from a small portion of the driveway to the garage will be collected in a trench drain and routed through a water quality unit for treatment prior to discharge through the flared end section with a rip-rap apron to the south.

Although all soils sampled in test pits TP-1 and TP-2, as well as the 8 test pits conducted in May 2023 and 5 conducted in April 2024, were identified as sandy loam (see above), the infiltration rate for silt loam (0.27-inches per hour) has been used in the infiltration system design to account for the materials found being primarily fill. Based upon the test pit data and groundwater monitoring performed in Spring 2024, the estimated seasonal high groundwater has been determined to be elevation 4.0. As such, to provide the minimum 2-feet of separation, the infiltration systems for the townhouse trench drains have been set with a bottom elevation of 7.0, the infiltration system collecting the majority of the driveways and parking areas has been set with a bottom elevation of 7.15, and the infiltration system collecting roofs and overflow from the townhouse trench drains has been set with a bottom elevation of 8.0. Groundwater mounding calculations for the 100-year event have been provided for all infiltration systems with less than 4.0-feet of separation to estimated seasonal high groundwater.

To provide emergency access to the sides and rear of the building, a reinforced grass access lane will be installed. A portion of this access lane will include a 6-foot wide, porous asphalt walkway to allow residents to have ADA/AAB accessible access the rear of the site. Both the reinforced grass and porous asphalt will allow stormwater runoff to freely infiltrate back to the ground and will result in negligible runoff.

Specifics of the project's compliance with the Stormwater Standards are discussed in detail in the following sections.

SECTION 2.0

DRAINAGE SUMMARY

2.01 Stormwater Standard 1 – New Stormwater Conveyances

Per Massachusetts Stormwater Management Standard #1, no new outfalls may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. No new untreated stormwater discharges are proposed. Rip-rap outlet protection sizing calculations are included in Section 6.0 of this Report.

2.02 Stormwater Standard 2 – Stormwater Runoff Rates

Watershed modeling was performed using HydroCAD Stormwater Modeling Software version 10.20, a computer aided design program that combines SCS runoff methodology with standard hydraulic calculations. A model of the site's hydrology was developed for both pre- and post-development conditions to assess the effects of the proposed development on the project site and surrounding areas.

Stormwater runoff was modeled using data from the NOAA 14++ rainfall atlas. The NOAA 14++ precipitation values are higher than the TP-40 rainfall values that are required by Wetlands Protection Act (WPA) and consistent with the requirements of the updated Arlington Wetland Bylaw. The following rainfall values have been used in the analysis and the NOAA 14++ data is included in Appendix D:

Storm Frequency	NOAA 14++ Rainfall (Inches)
2-year	4.02
10-year	6.40
25-year	8.30
50-year	9.67
100-year	11.50

The stormwater management system for the project has been designed such that the post-development conditions result in no increase to peak runoff rates off the property for the 2, 10, 25, 50, and 100-year, 24-hour storm events, as detailed in the table below.

Peak Flow Discharge Rates

Node 1L – Flow to Wetlands

Storm Event	Pre-Development Peak Discharge Rate (cfs)	Post-Development Peak Discharge Rate (cfs)	Change in Peak Discharge Rate (cfs)
2-Year	3.7	3.6	-0.1
10-Year	9.0	9.0	0.0
25-Year	13.7	13.7	0.0
50-Year	17.2	17.0	-0.2
100-Year	22.0	21.4	-0.6

Node 2L – Flow Towards Street

Storm Event	Pre-Development Peak Discharge Rate (cfs)	Post-Development Peak Discharge Rate (cfs)	Change in Peak Discharge Rate (cfs)
2-Year	0.3	0.3	0.0
10-Year	0.7	0.6	-0.1
25-Year	1.0	0.9	-0.1
50-Year	1.2	1.1	-0.1
100-Year	1.5	1.3	-0.2

Node 100L – Total Flows

Storm Event	Pre-Development Peak Discharge Rate (cfs)	Post-Development Peak Discharge Rate (cfs)	Change in Peak Discharge Rate (cfs)
2-Year	3.8	3.8	0.0
10-Year	9.4	9.4	0.0
25-Year	14.2	14.2	0.0
50-Year	17.9	17.8	-0.1
100-Year	22.7	22.3	-0.4

2.03 Stormwater Standard 3 – Groundwater Recharge

Groundwater recharge is provided on site via multiple underground structural infiltration systems beneath the surface parking area to the north of the building and smaller systems beneath each individual driveway of the duplex townhouses. Overall, the project will result in no loss of annual recharge to groundwater as required by Standard 3. Refer to Section 6.0 of this Report for groundwater recharge information.

As the townhouse driveway infiltration systems and the infiltration system collecting the majority of the driveway have more than 2-feet but less than 4-feet separation to estimated seasonal high groundwater, a mounding analysis has been performed in accordance with the Hantush Method for each to ensure that a groundwater mound does not extend into the bottom of the infiltration system preventing infiltration of the required recharge volume. This analysis has been performed utilizing the infiltration volume that occurs during the 100-year storm event and is included in Section 6.0 of this Report. As the system that collects the 4-story building roof has 4-feet of separation to groundwater, a mounding analysis is not required for this system.

2.04 Stormwater Standard 4 – TSS Removal

As a new development, the Project stormwater management system will achieve a TSS removal greater than 80%. The proposed stormwater management system has been designed to provide treatment of runoff in order to reduce suspended solids prior to discharge off-site through the implementation of the following best management practices:

- Deep Sump Hooded Catch Basins
- Proprietary Hydrodynamic Separators

- Underground Stormwater Infiltration Systems
- Rain Garden

The water quality volume is defined as the runoff volume requiring TSS Removal for the site and is equal to 0.5-inches of runoff over the total impervious area of the post-development site. The required water quality volume for the project is provided in Section 6.0 of this Report.

The underground infiltration systems have been sized to treat the required water quality volume and calculations are included in Section 6.0 of this Report.

A long-term pollution prevention plan complying with the requirements of Standard 4 is included in Section 4.0 of this Report.

2.05 Stormwater Standard 5 – Land Uses with Higher Potential Pollutant Loads

This standard is not applicable as the proposed project is not a land use with higher potential pollutant loads (LUHPPL).

2.06 Stormwater Standard 6 – Stormwater Discharges to a Critical Area

This standard is not applicable as runoff from the project site does not discharge to a critical area.

2.07 Stormwater Standard 7 – Redevelopment Projects

This project is a new development and therefore has been designed to fully comply with the Stormwater Management Standards.

2.08 Stormwater Standard 8 – Sedimentation and Erosion Control Plan

Erosion and sedimentation controls are shown on the Project Plans. Additionally, a Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan is included in Section 3.0 of this Report.

2.09 Stormwater Standard 9 – Long Term Operation and Maintenance Plan

A Long-Term Operation and Maintenance Plan is included in Section 4.0 of this Report.

2.10 Stormwater Standard 10 – Illicit Discharges

There are no known illicit discharges on the project site, and none are proposed. An illicit discharge compliance statement is included in Section 6.0 and will be signed by the Applicant prior to issuance of any permits.

2.11 Conclusion

The project has been designed in accordance with DEP Stormwater Management Standards. Through the construction of the aforementioned stormwater systems, the project will provide peak rate attenuation, TSS removal and groundwater recharge.

2.12 Compensatory Flood Storage

A portion of the project site is located within the 1% Chance Annual Flood as defined by FEMA, which is regulated under the Wetlands Protection Act as Bordering Land Subject to Flooding (BLSF). In order to protect the values provided by BLSF and prevent downstream flooding impacts, the project is required to provide compensatory flood storage on a 1-foot incremental basis to match whatever is lost due to the project's development. In order to provide this compensatory flood storage, the project will minimize the area of BLSF impacted and regrade a portion of the project property southeast of the proposed building as shown on the Plans. This regraded area will provide compensatory flood storage at a 2 to 1 ratio for any flood storage lost. A breakdown of the flood storage impacts and compensatory storage provided is shown below:

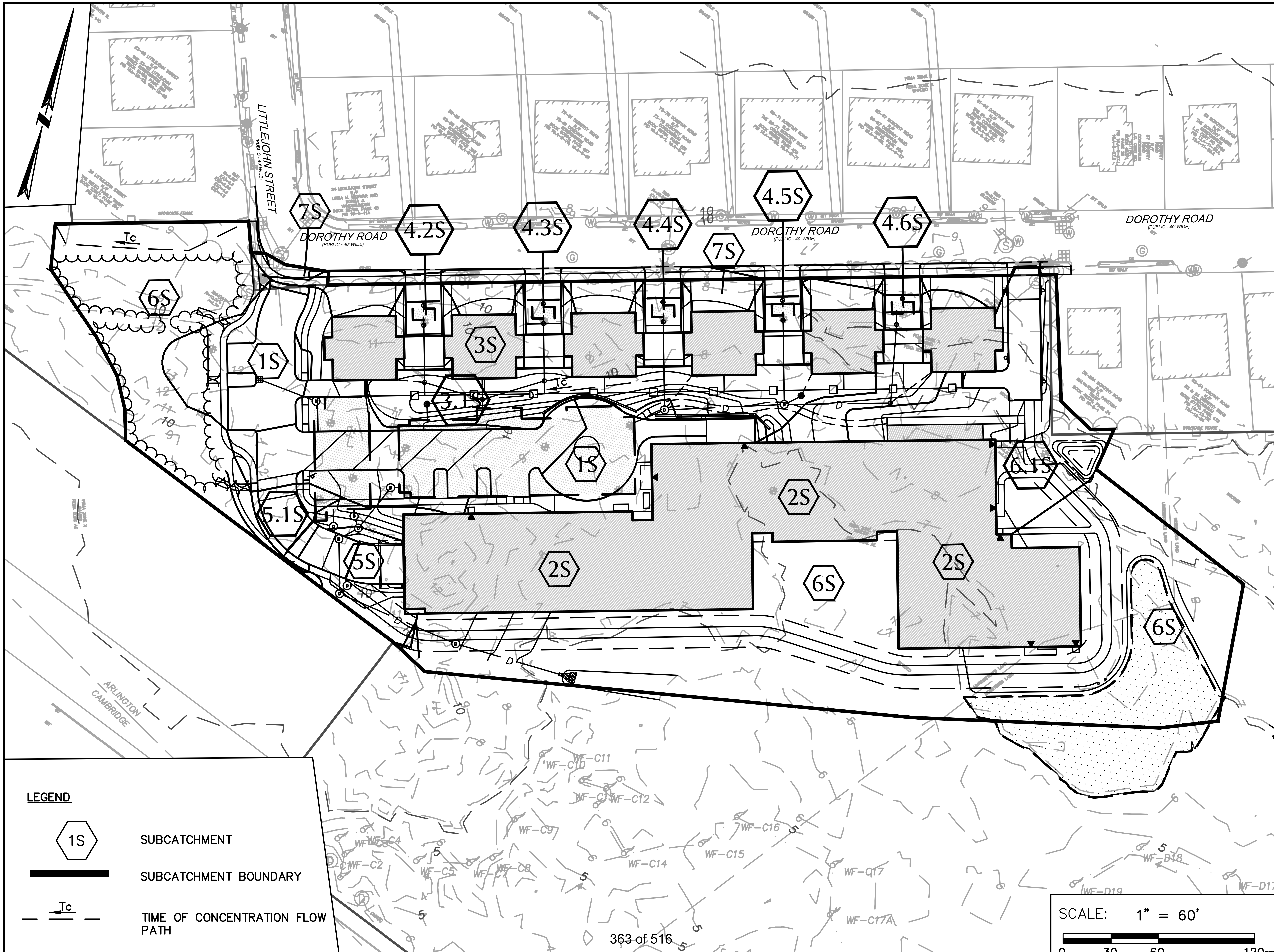
Elevations	Existing Incremental Available Flood Storage (CU.FT.)	Incremental Available Flood Storage with No Compensatory Storage (CU.FT.)	Incremental Flood Storage Change w/No Compensatory Storage (CU.FT.)	Proposed Incremental Compensatory Storage (CU.FT.)	Ratio of Compensatory Storage to Storage Lost
5.0 - 6.0	**136.0**	**67.5**	**-68.5**	**146.0**	**2.1**
6.0 - 6.8	**9,327.6**	**5,003.2**	**-4,324.4**	**9,014.8**	**2.1**

As shown above, the project will exceed the 2 to 1 ratio of compensatory flood storage for all flood storage lost due to the project development. In addition, as shown on the Plans, the proposed compensatory storage is hydrologically connected to the flood plain impacted by the project. Therefore, the project as proposed meets the applicable requirements for BLSF in the Wetlands Protection Act.

SECTION 5.0

HYDROLOGY CALCULATIONS

5.03 PROPOSED WATERSHED PLAN



THORNDIKE PLACE

DOROTHY ROAD

ARLINGTON
MASSACHUSETTS
(MIDDLESEX COUNTY)

PROPOSED WATERSHED PLAN

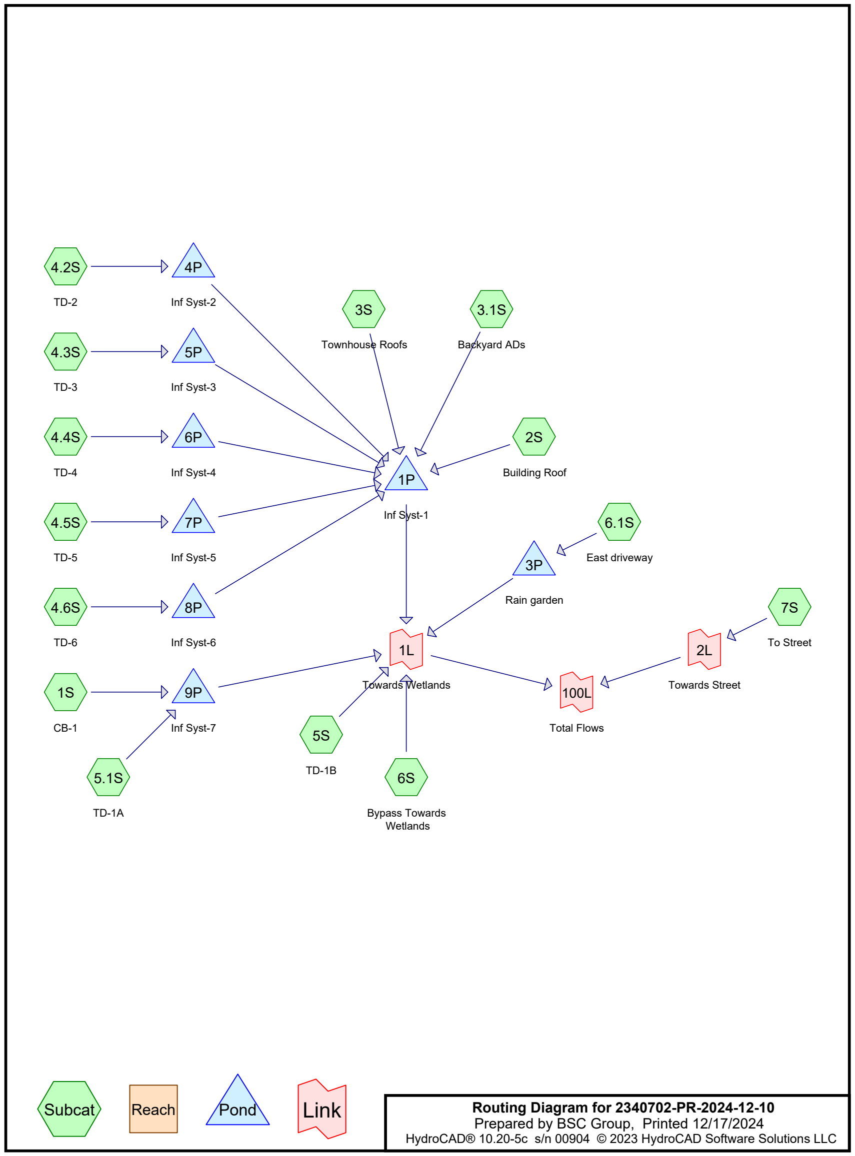
NOVEMBER 3, 2020

PREPARED FOR:
ARLINGTON LAND REALTY
84 SHERMAN STREET
CAMBRIDGE, MA

BSC GROUP
803 Summer Street
Boston, Massachusetts
02127
617 896 4300

Job No.: 23407.02
Date: 11/3/2020
Scale: 1" = 60'
Revised: 12/10/2024
Dwg No: PRW
File: C:\DRAINAGE DESIGN\2340700-PRW

5.04 PROPOSED HYDROLOGY CALCULATIONS (HYDROCAD™ PRINTOUTS)



Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	4.02	2
2	10-Year	Type III 24-hr		Default	24.00	1	6.40	2
3	25-Year	Type III 24-hr		Default	24.00	1	8.30	2
4	50-Year	Type III 24-hr		Default	24.00	1	9.67	2
5	100-Year	Type III 24-hr		Default	24.00	1	11.50	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
74,381	74	>75% Grass cover, Good, HSG C (1S, 3.1S, 4.2S, 4.3S, 4.4S, 4.5S, 4.6S, 5.1S, 5S, 6.1S, 6S, 7S)
220	89	Gravel roads, HSG C (6.1S)
411	89	Gravel sidewalk, HSG C (3.1S)
25,874	98	Paved parking, HSG C (1S, 4.2S, 4.3S, 4.4S, 4.5S, 4.6S, 5.1S, 5S, 7S)
6,444	98	Paved roads w/curbs & sewers, HSG C (6.1S)
46,099	98	Roofs, HSG C (2S, 3S, 6S)
272	98	Unconnected pavement, HSG C (3.1S)
4,985	70	Woods, Good, HSG C (6S)
158,686	**86**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
158,686	HSG C	1S, 2S, 3.1S, 3S, 4.2S, 4.3S, 4.4S, 4.5S, 4.6S, 5.1S, 5S, 6.1S, 6S, 7S
0	HSG D	
0	Other	
158,686		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
0	0	74,381	0	0	74,381	>75% Grass cover, Good
0	0	220	0	0	220	Gravel roads
0	0	411	0	0	411	Gravel sidewalk
0	0	25,874	0	0	25,874	Paved parking
0	0	6,444	0	0	6,444	Paved roads w/curbs & sewers
0	0	46,099	0	0	46,099	Roofs
0	0	272	0	0	272	Unconnected pavement
0	0	4,985	0	0	4,985	Woods, Good
0	**0**	**158,686**	**0**	**0**	**158,686**	**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: CB-1 Runoff Area=22,742 sf 72.16% Impervious Runoff Depth=3.04"
Tc=6.0 min CN=91 Runoff=1.8 cfs 5,755 cf

Subcatchment2S: Building Roof Runoff Area=32,925 sf 100.00% Impervious Runoff Depth=3.79"
Tc=6.0 min CN=98 Runoff=3.0 cfs 10,385 cf

Subcatchment3.1S: Backyard ADs Runoff Area=8,985 sf 3.03% Impervious Runoff Depth=1.68"
Flow Length=147' Tc=10.3 min CN=75 Runoff=0.3 cfs 1,259 cf

Subcatchment3S: Townhouse Roofs Runoff Area=13,067 sf 100.00% Impervious Runoff Depth=3.79"
Tc=6.0 min CN=98 Runoff=1.2 cfs 4,122 cf

Subcatchment4.2S: TD-2 Runoff Area=1,112 sf 95.68% Impervious Runoff Depth=3.67"
Tc=6.0 min CN=97 Runoff=0.1 cfs 340 cf

Subcatchment4.3S: TD-3 Runoff Area=1,105 sf 97.29% Impervious Runoff Depth=3.67"
Tc=6.0 min CN=97 Runoff=0.1 cfs 338 cf

Subcatchment4.4S: TD-4 Runoff Area=1,104 sf 97.46% Impervious Runoff Depth=3.67"
Tc=6.0 min CN=97 Runoff=0.1 cfs 338 cf

Subcatchment4.5S: TD-5 Runoff Area=1,082 sf 98.06% Impervious Runoff Depth=3.79"
Tc=6.0 min CN=98 Runoff=0.1 cfs 341 cf

Subcatchment4.6S: TD-6 Runoff Area=1,056 sf 99.24% Impervious Runoff Depth=3.79"
Tc=6.0 min CN=98 Runoff=0.1 cfs 333 cf

Subcatchment5.1S: TD-1A Runoff Area=1,389 sf 84.59% Impervious Runoff Depth=3.34"
Tc=6.0 min CN=94 Runoff=0.1 cfs 387 cf

Subcatchment5S: TD-1B Runoff Area=4,462 sf 42.78% Impervious Runoff Depth=2.39"
Tc=6.0 min CN=84 Runoff=0.3 cfs 888 cf

Subcatchment6.1S: East driveway Runoff Area=12,275 sf 52.50% Impervious Runoff Depth=2.66"
Tc=6.0 min CN=87 Runoff=0.9 cfs 2,716 cf

Subcatchment6S: Bypass Towards Runoff Area=51,539 sf 0.21% Impervious Runoff Depth=1.61"
Flow Length=125' Tc=14.0 min CN=74 Runoff=1.7 cfs 6,919 cf

Subcatchment7S: To Street Runoff Area=5,843 sf 18.07% Impervious Runoff Depth=1.90"
Tc=6.0 min CN=78 Runoff=0.3 cfs 927 cf

Pond 1P: Inf Syst-1 Peak Elev=9.37' Storage=8,769 cf Inflow=4.8 cfs 16,622 cf
Discarded=0.1 cfs 13,377 cf Primary=0.3 cfs 3,246 cf Outflow=0.4 cfs 16,622 cf

Pond 3P: Rain garden Peak Elev=6.42' Storage=216 cf Inflow=0.9 cfs 2,716 cf
Discarded=0.0 cfs 444 cf Primary=0.9 cfs 2,272 cf Outflow=0.9 cfs 2,716 cf

Pond 4P: Inf Syst-2 Peak Elev=9.41' Storage=129 cf Inflow=0.1 cfs 340 cf
Discarded=0.0 cfs 156 cf Primary=0.1 cfs 171 cf Outflow=0.1 cfs 327 cf

Pond 5P: Inf Syst-3 Peak Elev=9.55' Storage=134 cf Inflow=0.1 cfs 338 cf
Discarded=0.0 cfs 156 cf Primary=0.1 cfs 163 cf Outflow=0.1 cfs 319 cf

Pond 6P: Inf Syst-4 Peak Elev=9.55' Storage=134 cf Inflow=0.1 cfs 338 cf
Discarded=0.0 cfs 156 cf Primary=0.1 cfs 163 cf Outflow=0.1 cfs 319 cf

Pond 7P: Inf Syst-5 Peak Elev=9.18' Storage=117 cf Inflow=0.1 cfs 341 cf
Discarded=0.0 cfs 157 cf Primary=0.1 cfs 183 cf Outflow=0.1 cfs 341 cf

Pond 8P: Inf Syst-6 Peak Elev=9.20' Storage=118 cf Inflow=0.1 cfs 333 cf
Discarded=0.0 cfs 157 cf Primary=0.1 cfs 175 cf Outflow=0.1 cfs 332 cf

Pond 9P: Inf Syst-7 Peak Elev=7.84' Storage=1,431 cf Inflow=1.9 cfs 6,142 cf
Discarded=0.0 cfs 1,379 cf Primary=1.1 cfs 4,762 cf Outflow=1.1 cfs 6,142 cf

Link 1L: Towards Wetlands Inflow=3.6 cfs 18,088 cf
Primary=3.6 cfs 18,088 cf

Link 2L: Towards Street Inflow=0.3 cfs 927 cf
Primary=0.3 cfs 927 cf

Link 100L: Total Flows Inflow=3.8 cfs 19,014 cf
Primary=3.8 cfs 19,014 cf

Total Runoff Area = 158,686 sf Runoff Volume = 35,048 cf Average Runoff Depth = 2.65"
50.41% Pervious = 79,997 sf 49.59% Impervious = 78,689 sf

Summary for Subcatchment 1S: CB-1

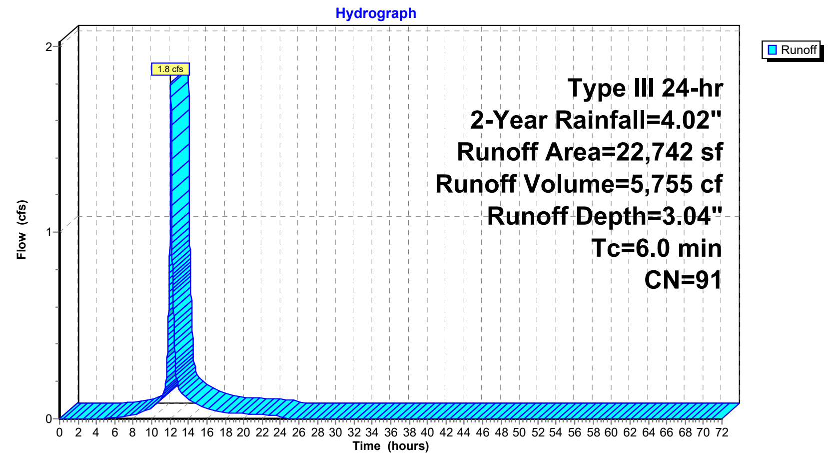
Runoff = 1.8 cfs @ 12.09 hrs, Volume= 5,755 cf, Depth= 3.04"
Routed to Pond 9P : Inf Syst-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
16,410	98	Paved parking, HSG C
6,332	74	>75% Grass cover, Good, HSG C
22,742	91	Weighted Average
6,332		27.84% Pervious Area
16,410		72.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 1S: CB-1



Summary for Subcatchment 2S: Building Roof

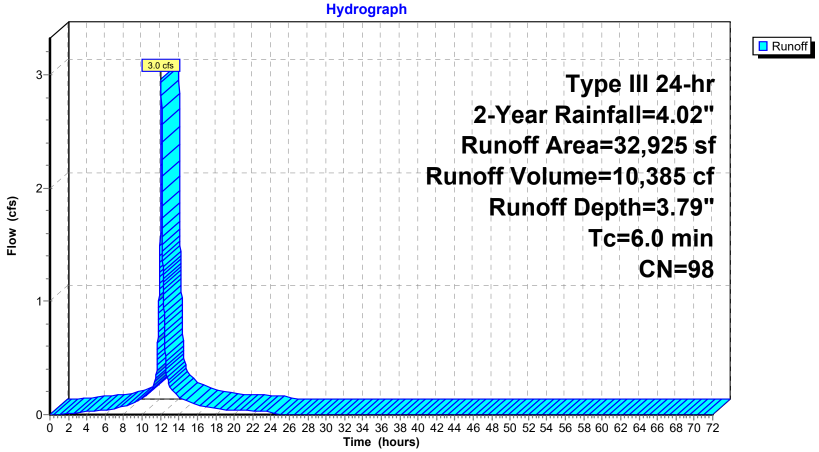
Runoff = 3.0 cfs @ 12.08 hrs, Volume= 10,385 cf, Depth= 3.79"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
32,925	98	Roofs, HSG C
32,925		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 2S: Building Roof



Summary for Subcatchment 3.1S: Backyard ADs

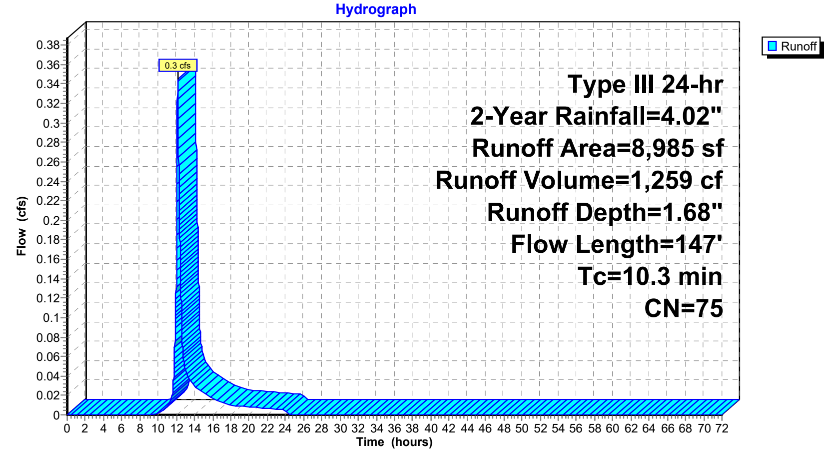
Runoff = 0.3 cfs @ 12.15 hrs, Volume= 1,259 cf, Depth= 1.68"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

	Area (sf)	CN	Description
	272	98	Unconnected pavement, HSG C
	8,302	74	>75% Grass cover, Good, HSG C
*	411	89	Gravel sidewalk, HSG C
	8,985	75	Weighted Average
	8,713		96.97% Pervious Area
	272		3.03% Impervious Area
	272		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	50	0.0142	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.23"
0.9	97	0.0154	1.86		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
10.3	147	Total			

Subcatchment 3.1S: Backyard ADs



Summary for Subcatchment 3S: Townhouse Roofs

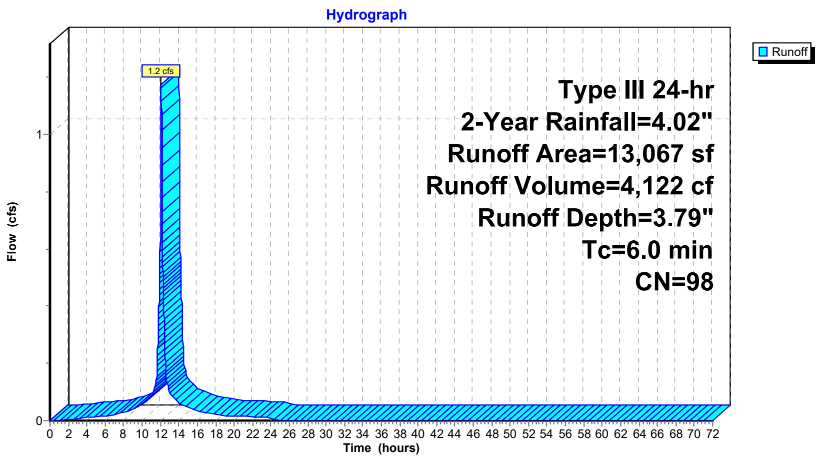
Runoff = 1.2 cfs @ 12.08 hrs, Volume= 4,122 cf, Depth= 3.79"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
13,067	98	Roofs, HSG C
13,067		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 3S: Townhouse Roofs



Summary for Subcatchment 4.2S: TD-2

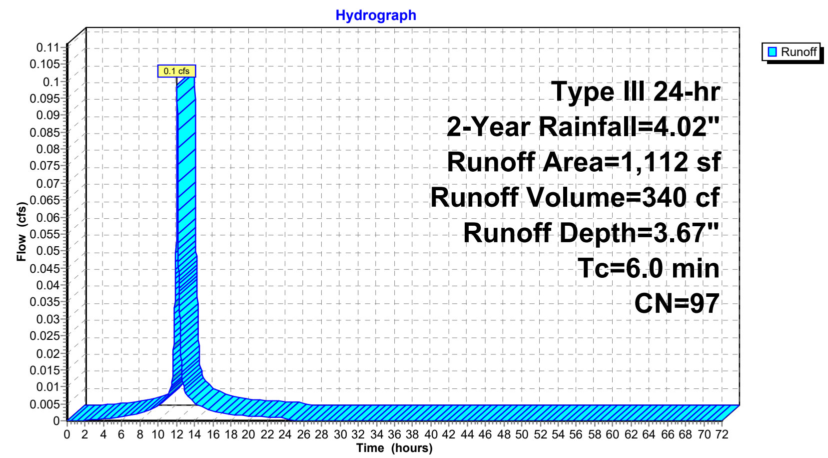
Runoff = 0.1 cfs @ 12.08 hrs, Volume= 340 cf, Depth= 3.67"
Routed to Pond 4P : Inf Syst-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
1,064	98	Paved parking, HSG C
48	74	>75% Grass cover, Good, HSG C
1,112	97	Weighted Average
48		4.32% Pervious Area
1,064		95.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.2S: TD-2



Summary for Subcatchment 4.3S: TD-3

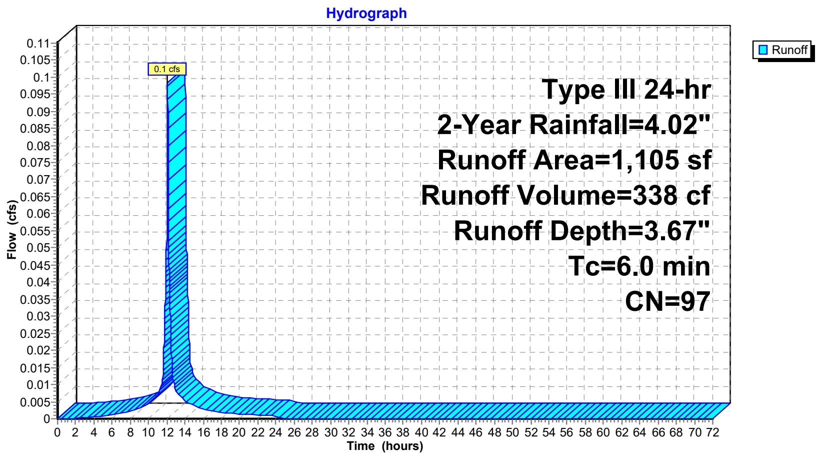
Runoff = 0.1 cfs @ 12.08 hrs, Volume= 338 cf, Depth= 3.67"
Routed to Pond 5P : Inf Syst-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
1,075	98	Paved parking, HSG C
30	74	>75% Grass cover, Good, HSG C
1,105	97	Weighted Average
30		2.71% Pervious Area
1,075		97.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.3S: TD-3



Summary for Subcatchment 4.4S: TD-4

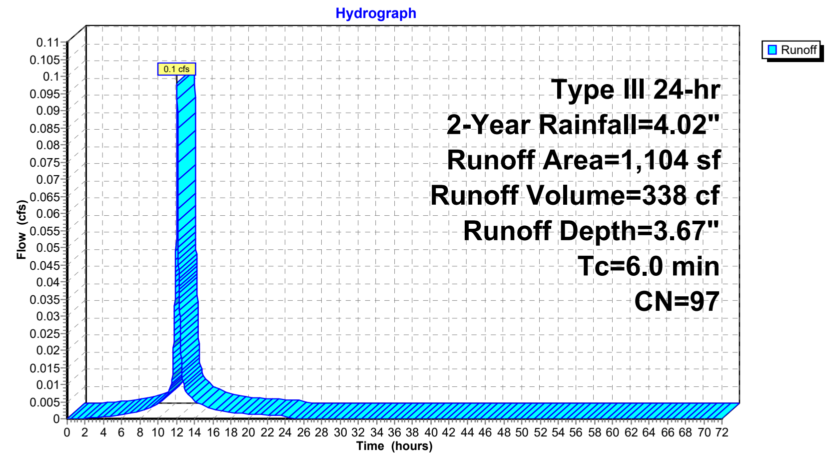
Runoff = 0.1 cfs @ 12.08 hrs, Volume= 338 cf, Depth= 3.67"
Routed to Pond 6P : Inf Syst-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
1,076	98	Paved parking, HSG C
28	74	>75% Grass cover, Good, HSG C
1,104	97	Weighted Average
28		2.54% Pervious Area
1,076		97.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.4S: TD-4



Summary for Subcatchment 4.5S: TD-5

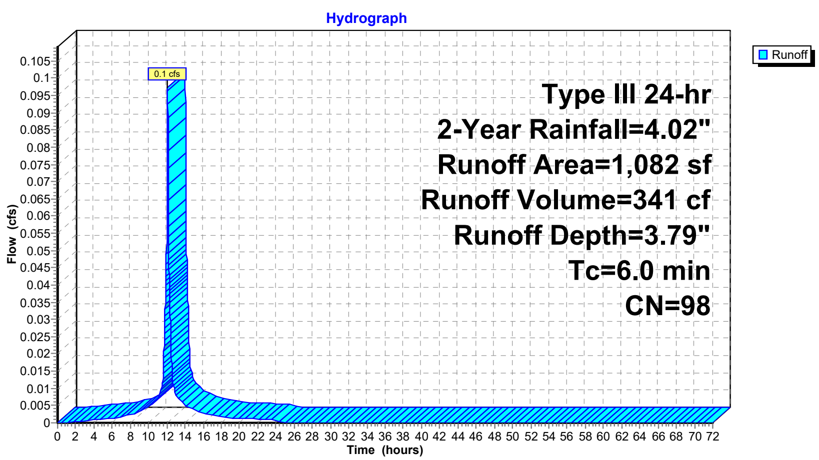
Runoff = 0.1 cfs @ 12.08 hrs, Volume= 341 cf, Depth= 3.79"
Routed to Pond 7P : Inf Syst-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
1,061	98	Paved parking, HSG C
21	74	>75% Grass cover, Good, HSG C
1,082	98	Weighted Average
21		1.94% Pervious Area
1,061		98.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.5S: TD-5



Summary for Subcatchment 4.6S: TD-6

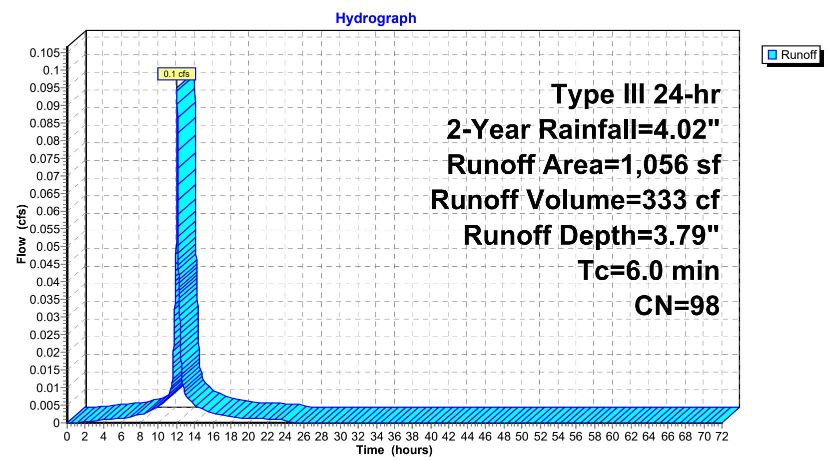
Runoff = 0.1 cfs @ 12.08 hrs, Volume= 333 cf, Depth= 3.79"
Routed to Pond 8P : Inf Syst-6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
1,048	98	Paved parking, HSG C
8	74	>75% Grass cover, Good, HSG C
1,056	98	Weighted Average
8		0.76% Pervious Area
1,048		99.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.6S: TD-6



Summary for Subcatchment 5.1S: TD-1A

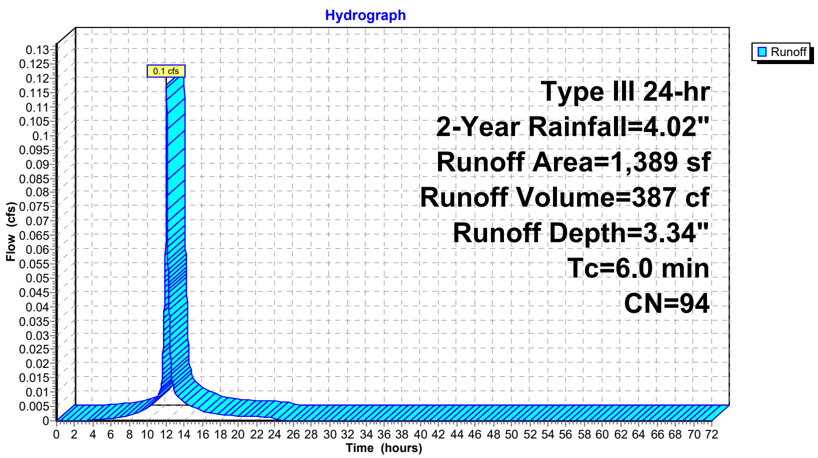
Runoff = 0.1 cfs @ 12.08 hrs, Volume= 387 cf, Depth= 3.34"
Routed to Pond 9P : Inf Syst-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
1,175	98	Paved parking, HSG C
214	74	>75% Grass cover, Good, HSG C
1,389	94	Weighted Average
214		15.41% Pervious Area
1,175		84.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 5.1S: TD-1A



Summary for Subcatchment 5S: TD-1B

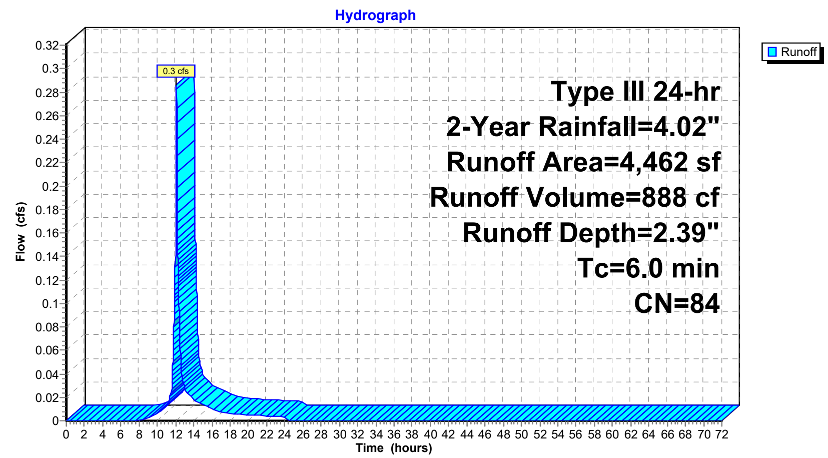
Runoff = 0.3 cfs @ 12.09 hrs, Volume= 888 cf, Depth= 2.39"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
1,909	98	Paved parking, HSG C
2,553	74	>75% Grass cover, Good, HSG C
4,462	84	Weighted Average
2,553		57.22% Pervious Area
1,909		42.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 5S: TD-1B



Summary for Subcatchment 6.1S: East driveway

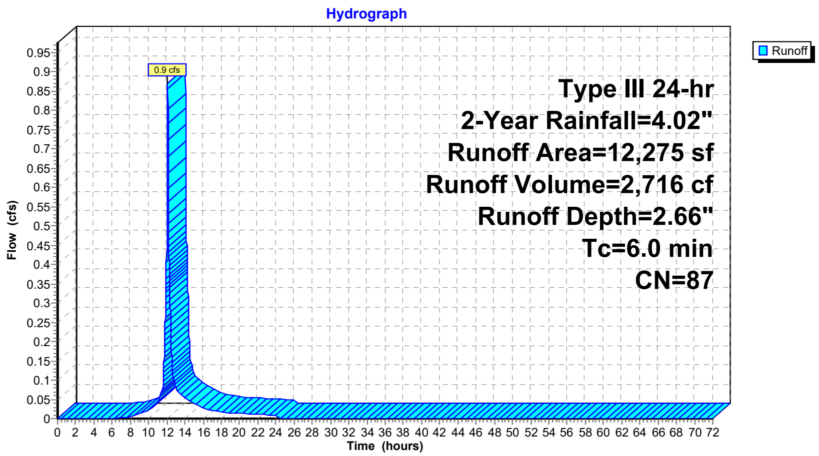
Runoff = 0.9 cfs @ 12.09 hrs, Volume= 2,716 cf, Depth= 2.66"
Routed to Pond 3P : Rain garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
5,611	74	>75% Grass cover, Good, HSG C
6,444	98	Paved roads w/curbs & sewers, HSG C
220	89	Gravel roads, HSG C
12,275	87	Weighted Average
5,831		47.50% Pervious Area
6,444		52.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 6.1S: East driveway



Summary for Subcatchment 6S: Bypass Towards Wetlands

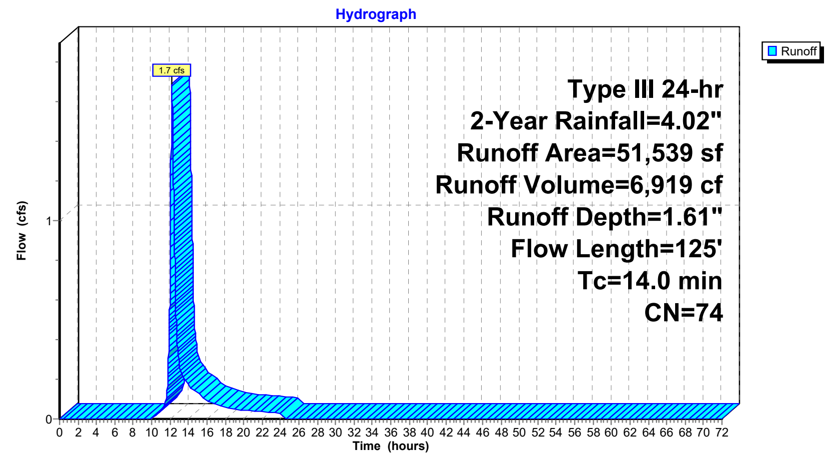
Runoff = 1.7 cfs @ 12.20 hrs, Volume= 6,919 cf, Depth= 1.61"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
4,985	70	Woods, Good, HSG C
46,447	74	>75% Grass cover, Good, HSG C
107	98	Roofs, HSG C
51,539	74	Weighted Average
51,432		99.79% Pervious Area
107		0.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	50	0.0220	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
2.2	75	0.0133	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	125	Total			

Subcatchment 6S: Bypass Towards Wetlands



Summary for Subcatchment 7S: To Street

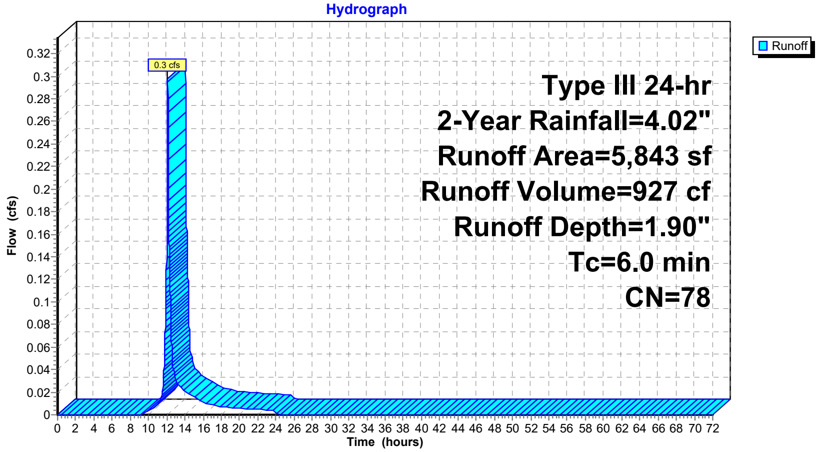
Runoff = 0.3 cfs @ 12.09 hrs, Volume= 927 cf, Depth= 1.90"
Routed to Link 2L : Towards Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=4.02"

Area (sf)	CN	Description
1,056	98	Paved parking, HSG C
4,787	74	>75% Grass cover, Good, HSG C
5,843	78	Weighted Average
4,787		81.93% Pervious Area
1,056		18.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 7S: To Street



Summary for Pond 1P: Inf Syst-1

Inflow Area = 60,436 sf, 85.36% Impervious, Inflow Depth = 3.30" for 2-Year event
Inflow = 4.8 cfs @ 12.09 hrs, Volume= 16,622 cf
Outflow = 0.4 cfs @ 13.02 hrs, Volume= 16,622 cf, Atten= 91%, Lag= 55.8 min
Discarded = 0.1 cfs @ 8.25 hrs, Volume= 13,377 cf
Primary = 0.3 cfs @ 13.02 hrs, Volume= 3,246 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.37' @ 13.02 hrs Surf.Area= 7,459 sf Storage= 8,769 cf

Plug-Flow detention time= 660.2 min calculated for 16,620 cf (100% of inflow)
Center-of-Mass det. time= 660.3 min (1,423.4 - 763.1)

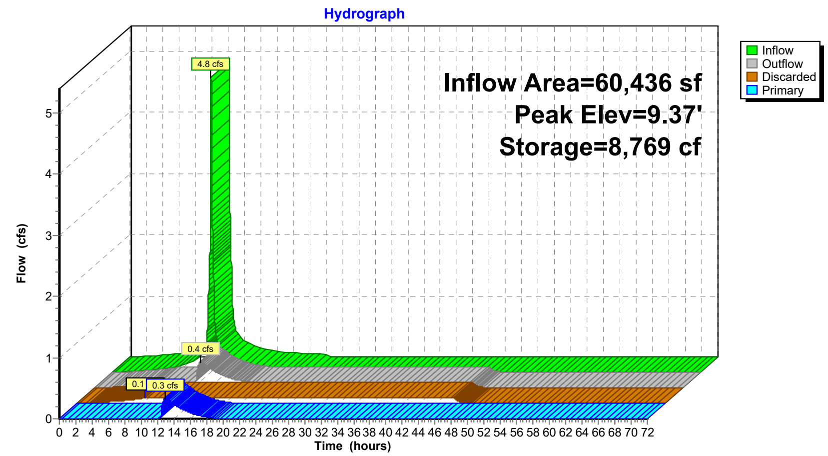
Volume	Invert	Avail.Storage	Storage Description
#1	8.00'	19,245 cf	**6.89'W x 14.06'L x 3.00'H StormTrap ST-1 Units (Irregular Shape)** x 77 22,378 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	8.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	8.00'	**15.0" Round Culvert** L= 26.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 8.00' / 7.13' S= 0.0335 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#3	Device 2	9.22'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	10.05'	**20.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 2	10.79'	**3.7' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.1 cfs @ 8.25 hrs HW=8.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.3 cfs @ 13.02 hrs HW=9.37' (Free Discharge)
└─**2=Culvert** (Passes 0.3 cfs of 5.1 cfs potential flow)
├─**3=Orifice/Grate** (Orifice Controls 0.3 cfs @ 1.23 fps)
├─**4=Orifice/Grate** (Controls 0.0 cfs)
└─**5=Sharp-Crested Rectangular Weir**(Controls 0.0 cfs)

Pond 1P: Inf Syst-1



Summary for Pond 3P: Rain garden

Inflow Area = 12,275 sf, 52.50% Impervious, Inflow Depth = 2.66" for 2-Year event
Inflow = 0.9 cfs @ 12.09 hrs, Volume= 2,716 cf
Outflow = 0.9 cfs @ 12.09 hrs, Volume= 2,716 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.0 cfs @ 12.09 hrs, Volume= 444 cf
Primary = 0.9 cfs @ 12.09 hrs, Volume= 2,272 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 6.42' @ 12.09 hrs Surf.Area= 412 sf Storage= 216 cf

Plug-Flow detention time= 90.5 min calculated for 2,715 cf (100% of inflow)
Center-of-Mass det. time= 90.6 min (900.2 - 809.6)

Volume	Invert	Avail.Storage	Storage Description
#1	5.60'	253 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

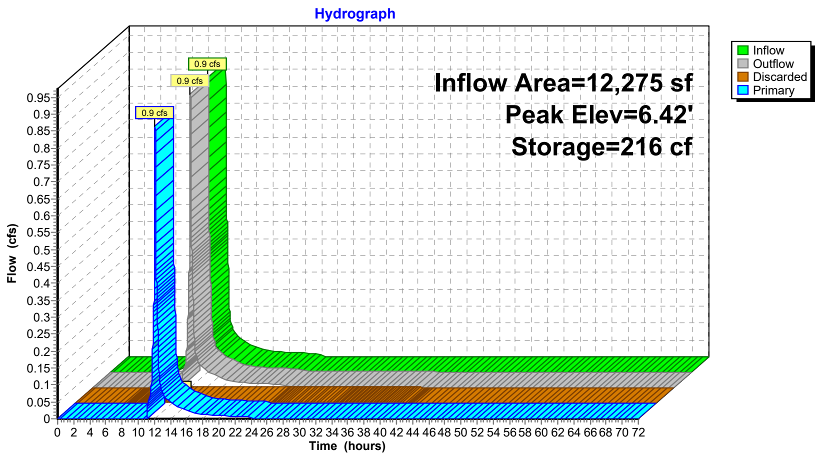
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.60	125	46.0	0	0	125
6.00	276	66.0	78	78	305
6.30	350	73.0	94	172	385
6.50	460	87.0	81	253	564

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.60'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	6.35'	**22.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.0 cfs @ 12.09 hrs HW=6.42' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.9 cfs @ 12.09 hrs HW=6.42' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 0.9 cfs @ 0.60 fps)

Pond 3P: Rain garden



Summary for Pond 4P: Inf Syst-2

Inflow Area = 1,112 sf, 95.68% Impervious, Inflow Depth = 3.67" for 2-Year event
Inflow = 0.1 cfs @ 12.08 hrs, Volume= 340 cf
Outflow = 0.1 cfs @ 12.11 hrs, Volume= 327 cf, Atten= 4%, Lag= 1.4 min
Discarded = 0.0 cfs @ 4.64 hrs, Volume= 156 cf
Primary = 0.1 cfs @ 12.11 hrs, Volume= 171 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.41' @ 12.11 hrs Surf.Area= 101 sf Storage= 129 cf

Plug-Flow detention time= 773.3 min calculated for 327 cf (96% of inflow)
Center-of-Mass det. time= 749.8 min (1,510.3 - 760.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

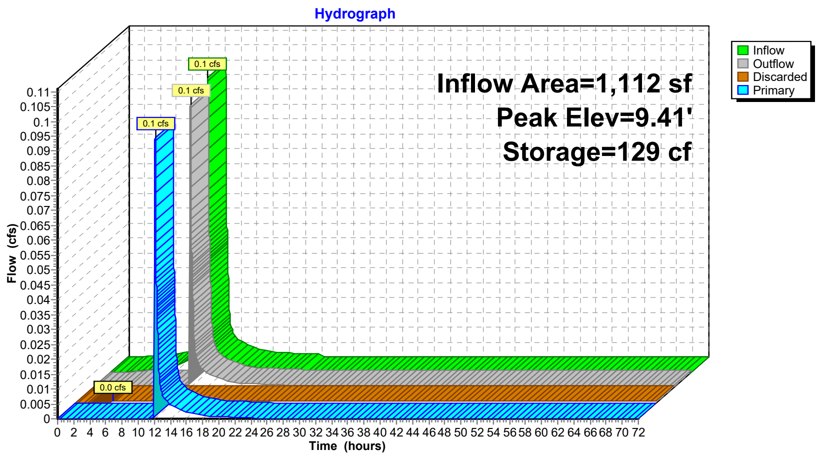
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.23'	**6.0" Round Culvert** L= 33.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.23' / 8.72' S= 0.0155 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 4.64 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.1 cfs @ 12.11 hrs HW=9.41' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.1 cfs @ 1.45 fps)

Pond 4P: Inf Syst-2



Summary for Pond 5P: Inf Syst-3

Inflow Area =	1,105 sf, 97.29% Impervious,	Inflow Depth = 3.67"	for 2-Year event
Inflow =	0.1 cfs @ 12.08 hrs,	Volume=	338 cf
Outflow =	0.1 cfs @ 12.12 hrs,	Volume=	319 cf, Atten= 8%, Lag= 2.2 min
Discarded =	0.0 cfs @ 4.68 hrs,	Volume=	156 cf
Primary =	0.1 cfs @ 12.12 hrs,	Volume=	163 cf

Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.55' @ 12.12 hrs Surf.Area= 101 sf Storage= 134 cf

Plug-Flow detention time= 799.9 min calculated for 319 cf (94% of inflow)
Center-of-Mass det. time= 768.5 min (1,529.0 - 760.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

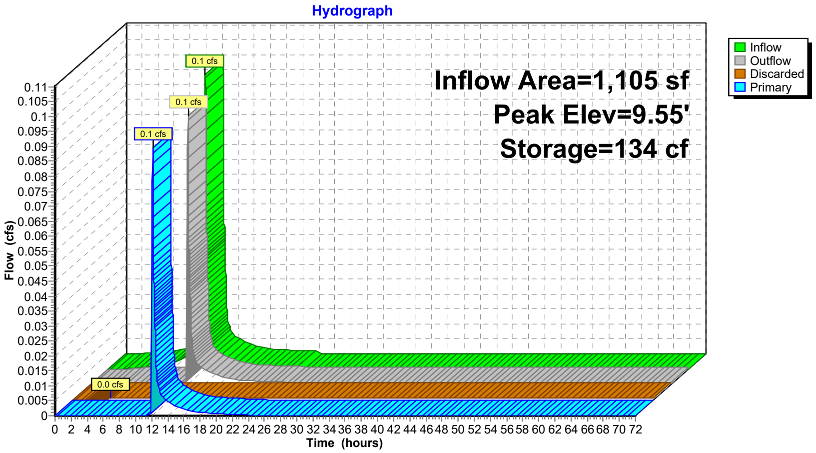
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.37'	**6.0" Round Culvert** L= 33.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.37' / 8.73' S= 0.0194 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 4.68 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.1 cfs @ 12.12 hrs HW=9.55' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.1 cfs @ 1.43 fps)

Pond 5P: Inf Syst-3



Summary for Pond 6P: Inf Syst-4

Inflow Area = 1,104 sf, 97.46% Impervious, Inflow Depth = 3.67" for 2-Year event
Inflow = 0.1 cfs @ 12.08 hrs, Volume= 338 cf
Outflow = 0.1 cfs @ 12.12 hrs, Volume= 319 cf, Atten= 9%, Lag= 2.2 min
Discarded = 0.0 cfs @ 4.68 hrs, Volume= 156 cf
Primary = 0.1 cfs @ 12.12 hrs, Volume= 163 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.55' @ 12.12 hrs Surf.Area= 101 sf Storage= 134 cf

Plug-Flow detention time= 800.6 min calculated for 319 cf (94% of inflow)
Center-of-Mass det. time= 769.2 min (1,529.7 - 760.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

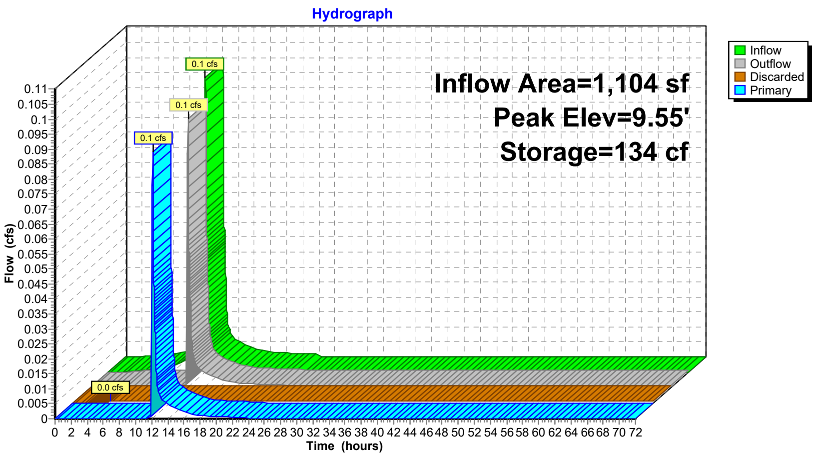
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.37'	**6.0" Round Culvert** L= 51.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.37' / 8.10' S= 0.0249 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 4.68 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.1 cfs @ 12.12 hrs HW=9.55' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.1 cfs @ 1.43 fps)

Pond 6P: Inf Syst-4



Summary for Pond 7P: Inf Syst-5

Inflow Area = 1,082 sf, 98.06% Impervious, Inflow Depth = 3.79" for 2-Year event
Inflow = 0.1 cfs @ 12.08 hrs, Volume= 341 cf
Outflow = 0.1 cfs @ 12.10 hrs, Volume= 341 cf, Atten= 1%, Lag= 0.7 min
Discarded = 0.0 cfs @ 3.77 hrs, Volume= 157 cf
Primary = 0.1 cfs @ 12.10 hrs, Volume= 183 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.18' @ 12.10 hrs Surf.Area= 101 sf Storage= 117 cf

Plug-Flow detention time= 722.0 min calculated for 341 cf (100% of inflow)
Center-of-Mass det. time= 721.1 min (1,473.0 - 751.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A** 241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1 Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf 10 Chambers in 2 Rows
		125 cf	Total Available Storage

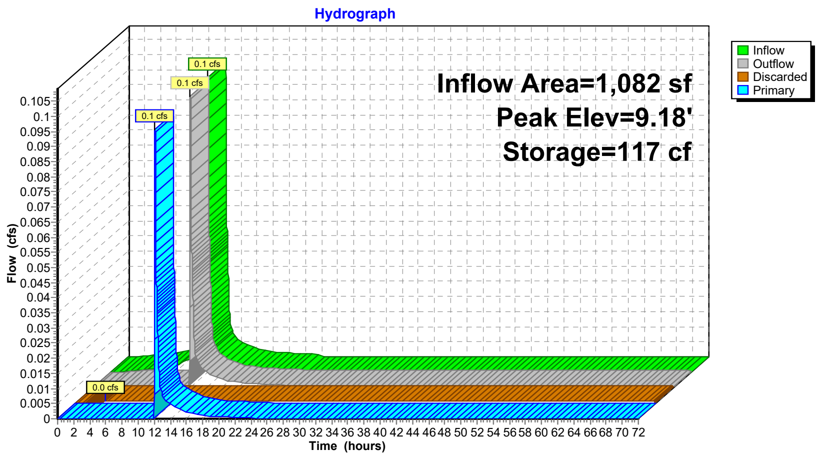
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**6.0" Round Culvert** L= 48.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.00' / 8.35' S= 0.0135 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 3.77 hrs HW=7.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.1 cfs @ 12.10 hrs HW=9.18' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.1 cfs @ 1.46 fps)

Pond 7P: Inf Syst-5



Summary for Pond 8P: Inf Syst-6

Inflow Area = 1,056 sf, 99.24% Impervious, Inflow Depth = 3.79" for 2-Year event
Inflow = 0.1 cfs @ 12.08 hrs, Volume= 333 cf
Outflow = 0.1 cfs @ 12.10 hrs, Volume= 332 cf, Atten= 1%, Lag= 0.8 min
Discarded = 0.0 cfs @ 3.86 hrs, Volume= 157 cf
Primary = 0.1 cfs @ 12.10 hrs, Volume= 175 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.20' @ 12.10 hrs Surf.Area= 101 sf Storage= 118 cf

Plug-Flow detention time= 739.6 min calculated for 332 cf (100% of inflow)
Center-of-Mass det. time= 738.4 min (1,490.2 - 751.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A** 241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1 Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf 10 Chambers in 2 Rows
		125 cf	Total Available Storage

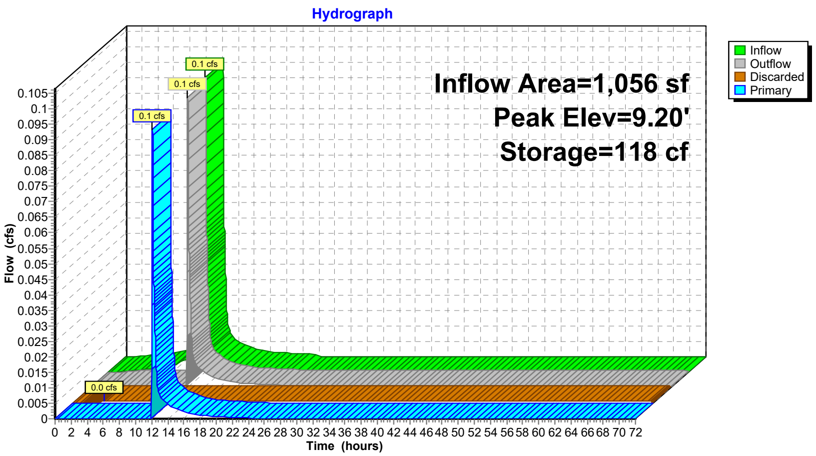
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**8.0" Round Culvert** L= 46.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.00' / 8.77' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 3.86 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.1 cfs @ 12.10 hrs HW=9.20' (Free Discharge)
└─**2=Culvert** (Barrel Controls 0.1 cfs @ 1.58 fps)

Pond 8P: Inf Syst-6



Summary for Pond 9P: Inf Syst-7

Inflow Area = 24,131 sf, 72.87% Impervious, Inflow Depth = 3.05" for 2-Year event
Inflow = 1.9 cfs @ 12.09 hrs, Volume= 6,142 cf
Outflow = 1.1 cfs @ 12.19 hrs, Volume= 6,142 cf, Atten= 41%, Lag= 6.4 min
Discarded = 0.0 cfs @ 7.94 hrs, Volume= 1,379 cf
Primary = 1.1 cfs @ 12.19 hrs, Volume= 4,762 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 7.84' @ 12.19 hrs Surf.Area= 2,422 sf Storage= 1,431 cf

Plug-Flow detention time= 91.3 min calculated for 6,141 cf (100% of inflow)
Center-of-Mass det. time= 91.4 min (884.7 - 793.3)

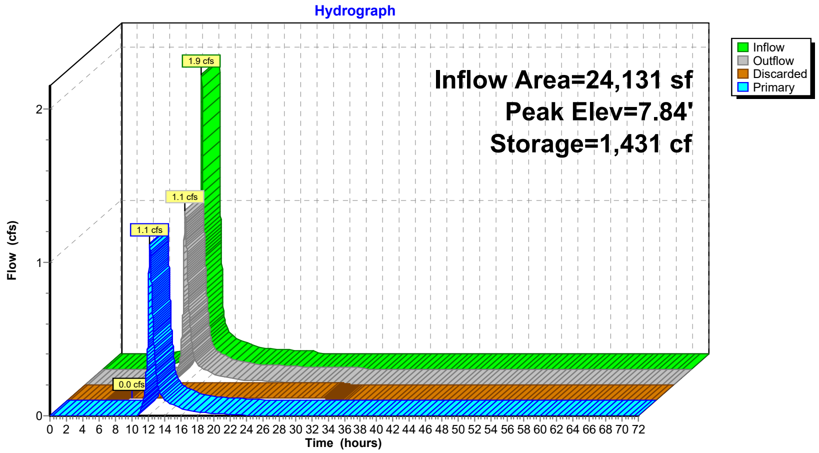
Volume	Invert	Avail.Storage	Storage Description
#1	7.15'	3,645 cf	**6.89'W x 14.06'L x 1.75'H StormTrap ST-1 Units (Irregular Shape)** x 25 4,238 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.15'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	7.15'	**12.0" Round Culvert** L= 4.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.15' / 7.13' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	7.35'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 7.94 hrs HW=7.17' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=1.1 cfs @ 12.19 hrs HW=7.84' (Free Discharge)
2=Culvert (Barrel Controls 1.1 cfs @ 2.76 fps)
3=Orifice/Grate (Passes 1.1 cfs of 1.6 cfs potential flow)

Pond 9P: Inf Syst-7

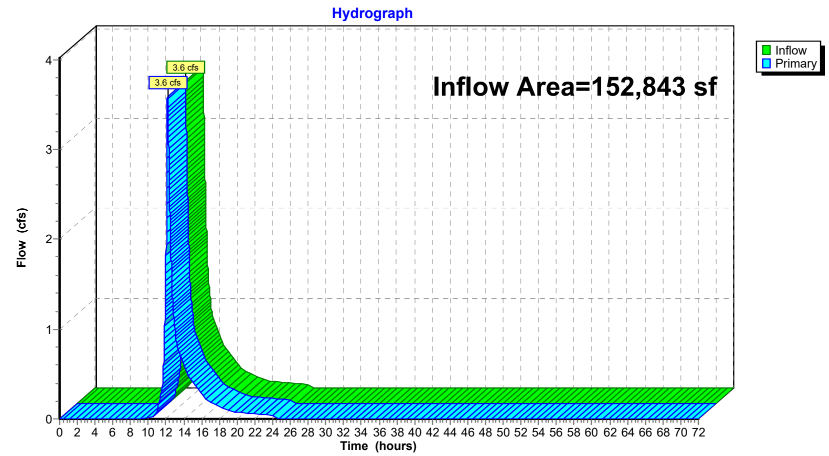


Summary for Link 1L: Towards Wetlands

Inflow Area = 152,843 sf, 50.79% Impervious, Inflow Depth = 1.42" for 2-Year event
Inflow = 3.6 cfs @ 12.16 hrs, Volume= 18,088 cf
Primary = 3.6 cfs @ 12.16 hrs, Volume= 18,088 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 1L: Towards Wetlands

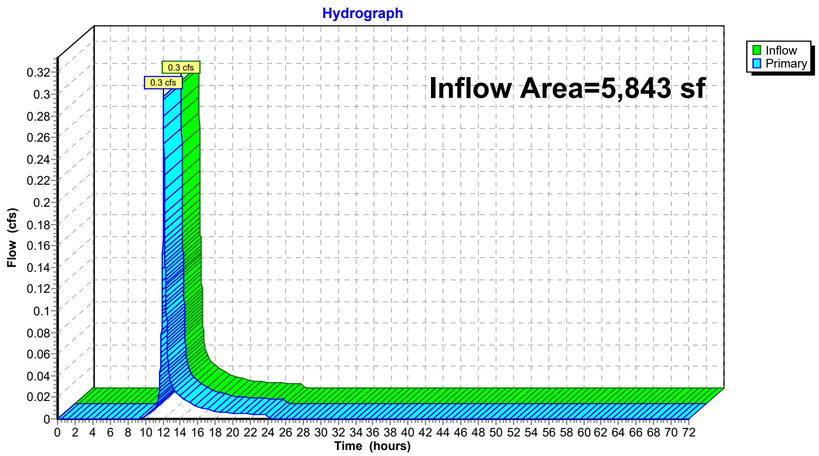


Summary for Link 2L: Towards Street

Inflow Area = 5,843 sf, 18.07% Impervious, Inflow Depth = 1.90" for 2-Year event
Inflow = 0.3 cfs @ 12.09 hrs, Volume= 927 cf
Primary = 0.3 cfs @ 12.09 hrs, Volume= 927 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 2L: Towards Street

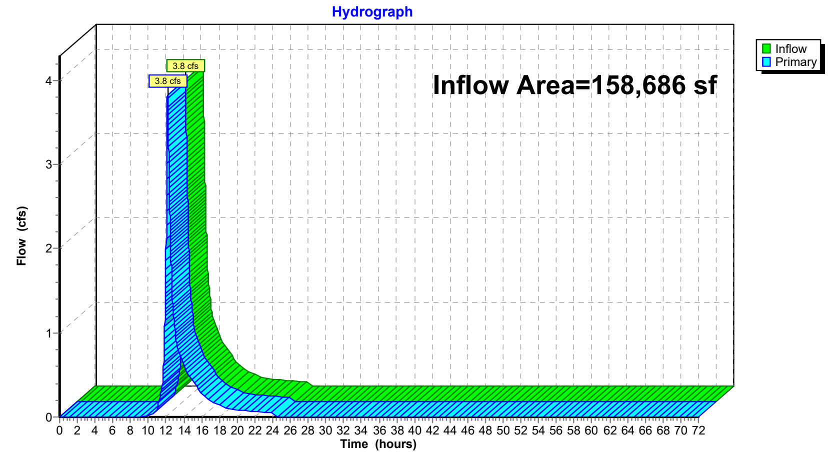


Summary for Link 100L: Total Flows

Inflow Area = 158,686 sf, 49.59% Impervious, Inflow Depth = 1.44" for 2-Year event
Inflow = 3.8 cfs @ 12.15 hrs, Volume= 19,014 cf
Primary = 3.8 cfs @ 12.15 hrs, Volume= 19,014 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 100L: Total Flows



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: CB-1 Runoff Area=22,742 sf 72.16% Impervious Runoff Depth=5.35"
Tc=6.0 min CN=91 Runoff=3.1 cfs 10,138 cf

Subcatchment2S: Building Roof Runoff Area=32,925 sf 100.00% Impervious Runoff Depth=6.16"
Tc=6.0 min CN=98 Runoff=4.7 cfs 16,905 cf

Subcatchment3.1S: Backyard ADs Runoff Area=8,985 sf 3.03% Impervious Runoff Depth=3.63"
Flow Length=147' Tc=10.3 min CN=75 Runoff=0.8 cfs 2,715 cf

Subcatchment3S: Townhouse Roofs Runoff Area=13,067 sf 100.00% Impervious Runoff Depth=6.16"
Tc=6.0 min CN=98 Runoff=1.9 cfs 6,709 cf

Subcatchment4.2S: TD-2 Runoff Area=1,112 sf 95.68% Impervious Runoff Depth=6.04"
Tc=6.0 min CN=97 Runoff=0.2 cfs 560 cf

Subcatchment4.3S: TD-3 Runoff Area=1,105 sf 97.29% Impervious Runoff Depth=6.04"
Tc=6.0 min CN=97 Runoff=0.2 cfs 556 cf

Subcatchment4.4S: TD-4 Runoff Area=1,104 sf 97.46% Impervious Runoff Depth=6.04"
Tc=6.0 min CN=97 Runoff=0.2 cfs 556 cf

Subcatchment4.5S: TD-5 Runoff Area=1,082 sf 98.06% Impervious Runoff Depth=6.16"
Tc=6.0 min CN=98 Runoff=0.2 cfs 556 cf

Subcatchment4.6S: TD-6 Runoff Area=1,056 sf 99.24% Impervious Runoff Depth=6.16"
Tc=6.0 min CN=98 Runoff=0.2 cfs 542 cf

Subcatchment5.1S: TD-1A Runoff Area=1,389 sf 84.59% Impervious Runoff Depth=5.69"
Tc=6.0 min CN=94 Runoff=0.2 cfs 659 cf

Subcatchment5S: TD-1B Runoff Area=4,462 sf 42.78% Impervious Runoff Depth=4.57"
Tc=6.0 min CN=84 Runoff=0.5 cfs 1,700 cf

Subcatchment6.1S: East driveway Runoff Area=12,275 sf 52.50% Impervious Runoff Depth=4.90"
Tc=6.0 min CN=87 Runoff=1.6 cfs 5,013 cf

Subcatchment6S: Bypass Towards Runoff Area=51,539 sf 0.21% Impervious Runoff Depth=3.52"
Flow Length=125' Tc=14.0 min CN=74 Runoff=3.8 cfs 15,135 cf

Subcatchment7S: To Street Runoff Area=5,843 sf 18.07% Impervious Runoff Depth=3.93"
Tc=6.0 min CN=78 Runoff=0.6 cfs 1,916 cf

Pond 1P: Inf Syst-1 Peak Elev=9.96' Storage=12,545 cf Inflow=8.0 cfs 28,251 cf
Discarded=0.1 cfs 14,540 cf Primary=2.2 cfs 13,710 cf Outflow=2.3 cfs 28,251 cf

Pond 3P: Rain garden Peak Elev=6.45' Storage=229 cf Inflow=1.6 cfs 5,013 cf
Discarded=0.0 cfs 477 cf Primary=1.6 cfs 4,537 cf Outflow=1.6 cfs 5,013 cf

Pond 4P: Inf Syst-2 Peak Elev=9.47' Storage=131 cf Inflow=0.2 cfs 560 cf
Discarded=0.0 cfs 159 cf Primary=0.2 cfs 388 cf Outflow=0.2 cfs 547 cf

Pond 5P: Inf Syst-3 Peak Elev=9.61' Storage=137 cf Inflow=0.2 cfs 556 cf
Discarded=0.0 cfs 159 cf Primary=0.2 cfs 379 cf Outflow=0.2 cfs 537 cf

Pond 6P: Inf Syst-4 Peak Elev=9.61' Storage=137 cf Inflow=0.2 cfs 556 cf
Discarded=0.0 cfs 159 cf Primary=0.2 cfs 378 cf Outflow=0.2 cfs 537 cf

Pond 7P: Inf Syst-5 Peak Elev=9.24' Storage=119 cf Inflow=0.2 cfs 556 cf
Discarded=0.0 cfs 160 cf Primary=0.2 cfs 395 cf Outflow=0.2 cfs 555 cf

Pond 8P: Inf Syst-6 Peak Elev=9.26' Storage=120 cf Inflow=0.2 cfs 542 cf
Discarded=0.0 cfs 160 cf Primary=0.2 cfs 382 cf Outflow=0.2 cfs 541 cf

Pond 9P: Inf Syst-7 Peak Elev=8.14' Storage=2,069 cf Inflow=3.3 cfs 10,797 cf
Discarded=0.0 cfs 1,502 cf Primary=2.1 cfs 9,295 cf Outflow=2.1 cfs 10,797 cf

Link 1L: Towards Wetlands Inflow=9.0 cfs 44,377 cf
Primary=9.0 cfs 44,377 cf

Link 2L: Towards Street Inflow=0.6 cfs 1,916 cf
Primary=0.6 cfs 1,916 cf

Link 100L: Total Flows Inflow=9.4 cfs 46,293 cf
Primary=9.4 cfs 46,293 cf

Total Runoff Area = 158,686 sf Runoff Volume = 63,661 cf Average Runoff Depth = 4.81"
50.41% Pervious = 79,997 sf 49.59% Impervious = 78,689 sf

Summary for Subcatchment 1S: CB-1

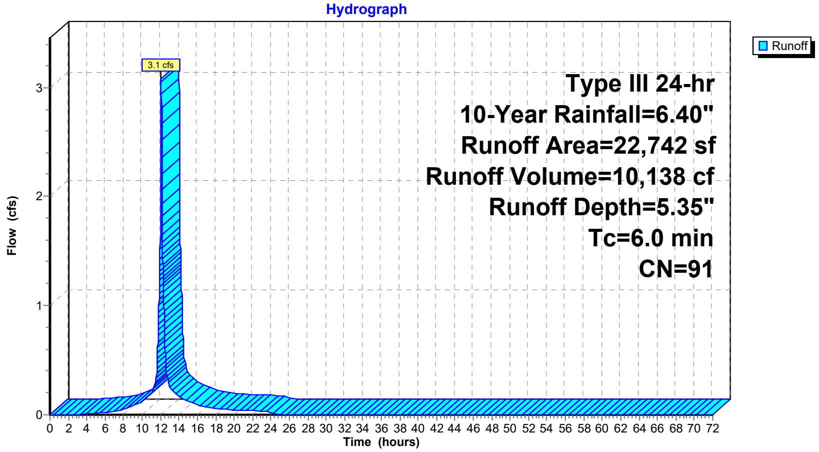
Runoff = 3.1 cfs @ 12.08 hrs, Volume= 10,138 cf, Depth= 5.35"
Routed to Pond 9P : Inf Syst-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
16,410	98	Paved parking, HSG C
6,332	74	>75% Grass cover, Good, HSG C
22,742	91	Weighted Average
6,332		27.84% Pervious Area
16,410		72.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 1S: CB-1



Summary for Subcatchment 2S: Building Roof

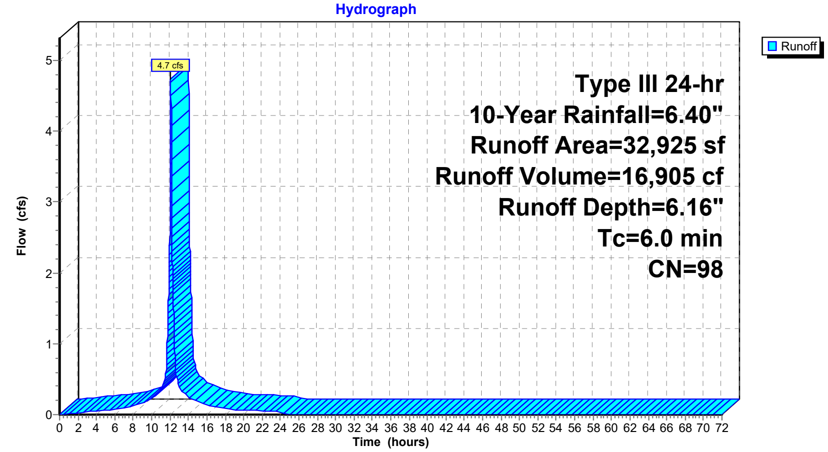
Runoff = 4.7 cfs @ 12.08 hrs, Volume= 16,905 cf, Depth= 6.16"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
32,925	98	Roofs, HSG C
32,925		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 2S: Building Roof



Summary for Subcatchment 3.1S: Backyard ADs

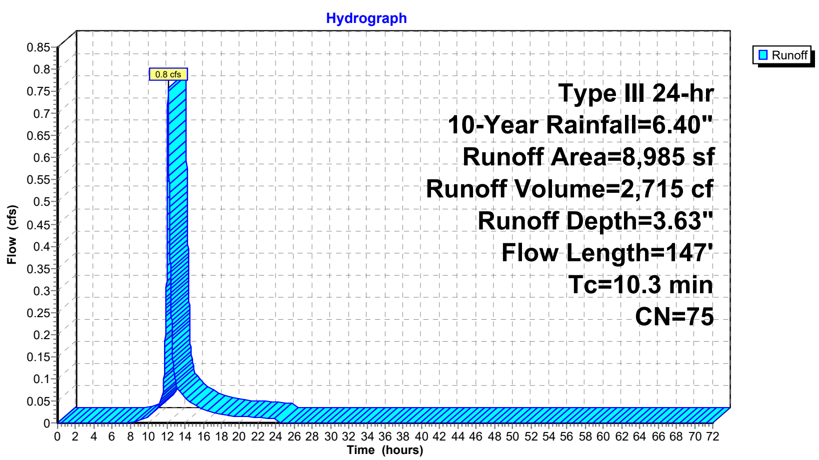
Runoff = 0.8 cfs @ 12.14 hrs, Volume= 2,715 cf, Depth= 3.63"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

	Area (sf)	CN	Description
	272	98	Unconnected pavement, HSG C
	8,302	74	>75% Grass cover, Good, HSG C
*	411	89	Gravel sidewalk, HSG C
	8,985	75	Weighted Average
	8,713		96.97% Pervious Area
	272		3.03% Impervious Area
	272		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	50	0.0142	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.23"
0.9	97	0.0154	1.86		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
10.3	147	Total			

Subcatchment 3.1S: Backyard ADs



Summary for Subcatchment 3S: Townhouse Roofs

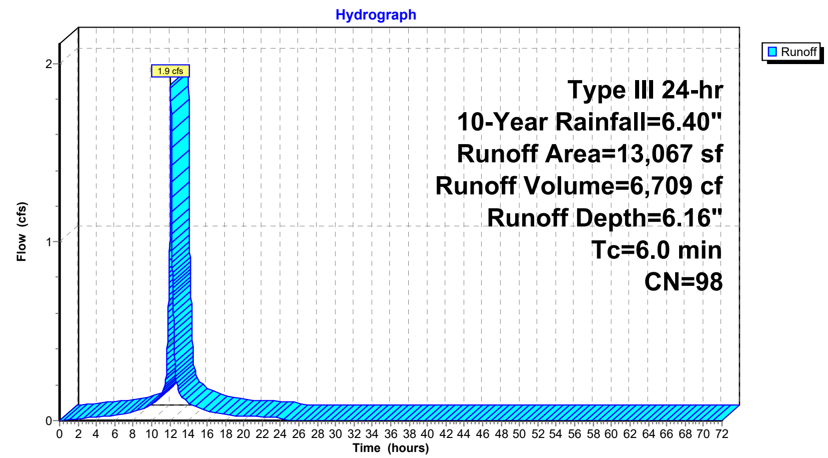
Runoff = 1.9 cfs @ 12.08 hrs, Volume= 6,709 cf, Depth= 6.16"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
13,067	98	Roofs, HSG C
13,067		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 3S: Townhouse Roofs



Summary for Subcatchment 4.2S: TD-2

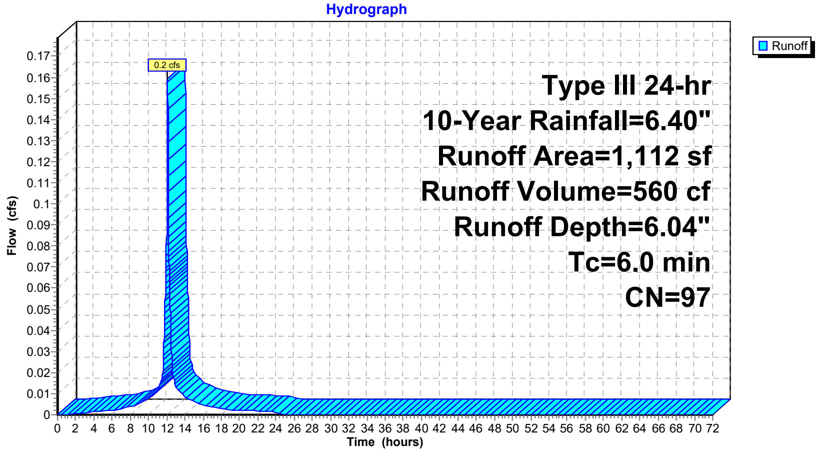
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 560 cf, Depth= 6.04"
Routed to Pond 4P : Inf Syst-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
1,064	98	Paved parking, HSG C
48	74	>75% Grass cover, Good, HSG C
1,112	97	Weighted Average
48		4.32% Pervious Area
1,064		95.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.2S: TD-2



Summary for Subcatchment 4.3S: TD-3

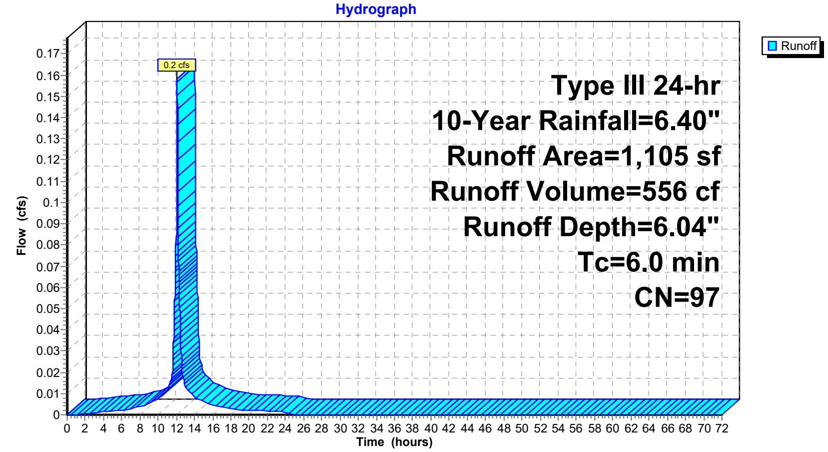
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 556 cf, Depth= 6.04"
Routed to Pond 5P : Inf Syst-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
1,075	98	Paved parking, HSG C
30	74	>75% Grass cover, Good, HSG C
1,105	97	Weighted Average
30		2.71% Pervious Area
1,075		97.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.3S: TD-3



Summary for Subcatchment 4.4S: TD-4

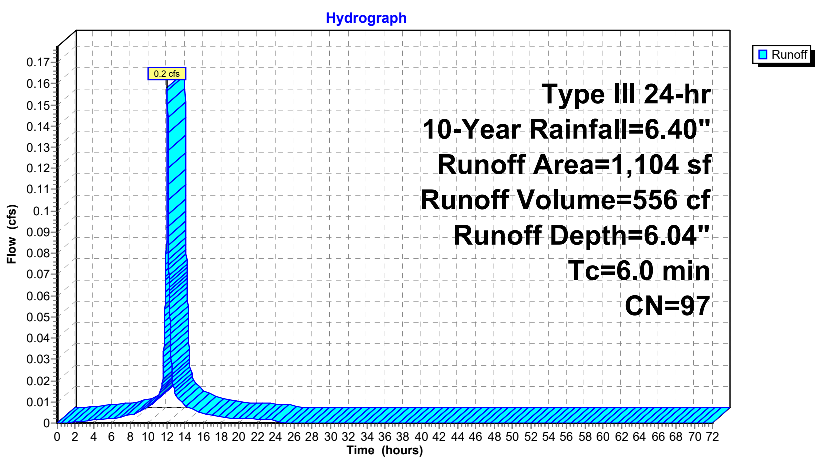
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 556 cf, Depth= 6.04"
Routed to Pond 6P : Inf Syst-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
1,076	98	Paved parking, HSG C
28	74	>75% Grass cover, Good, HSG C
1,104	97	Weighted Average
28		2.54% Pervious Area
1,076		97.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.4S: TD-4



Summary for Subcatchment 4.5S: TD-5

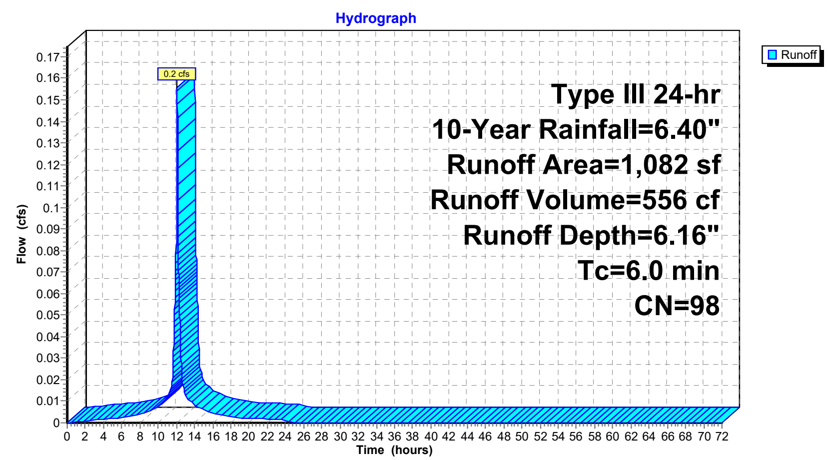
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 556 cf, Depth= 6.16"
Routed to Pond 7P : Inf Syst-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
1,061	98	Paved parking, HSG C
21	74	>75% Grass cover, Good, HSG C
1,082	98	Weighted Average
21		1.94% Pervious Area
1,061		98.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.5S: TD-5



Summary for Subcatchment 4.6S: TD-6

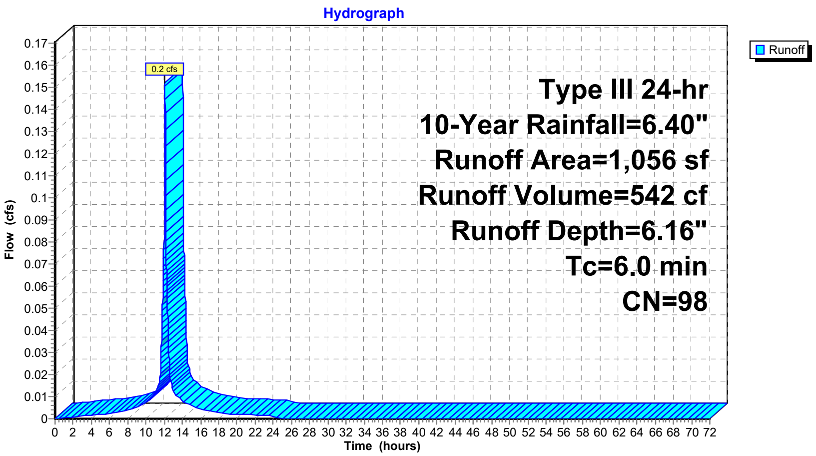
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 542 cf, Depth= 6.16"
Routed to Pond 8P : Inf Syst-6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
1,048	98	Paved parking, HSG C
8	74	>75% Grass cover, Good, HSG C
1,056	98	Weighted Average
8		0.76% Pervious Area
1,048		99.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.6S: TD-6



Summary for Subcatchment 5.1S: TD-1A

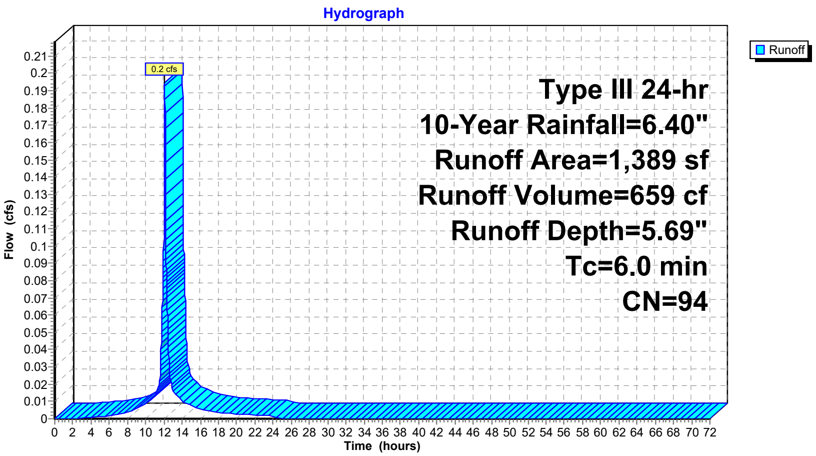
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 659 cf, Depth= 5.69"
Routed to Pond 9P : Inf Syst-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
1,175	98	Paved parking, HSG C
214	74	>75% Grass cover, Good, HSG C
1,389	94	Weighted Average
214		15.41% Pervious Area
1,175		84.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 5.1S: TD-1A



Summary for Subcatchment 5S: TD-1B

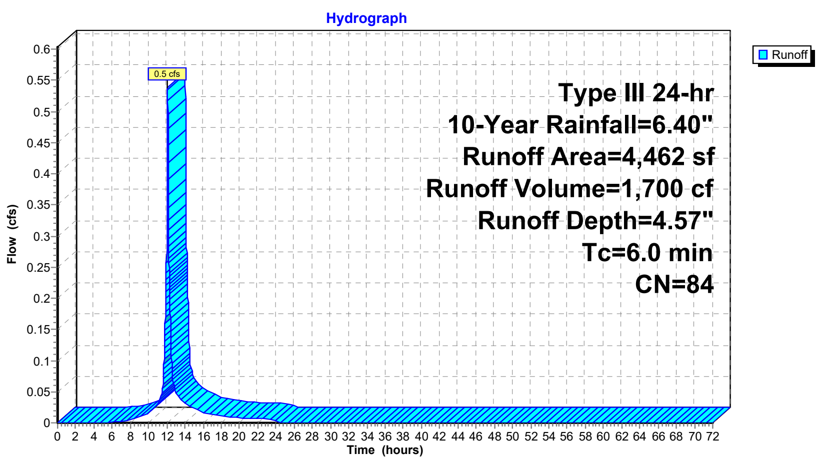
Runoff = 0.5 cfs @ 12.09 hrs, Volume= 1,700 cf, Depth= 4.57"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
1,909	98	Paved parking, HSG C
2,553	74	>75% Grass cover, Good, HSG C
4,462	84	Weighted Average
2,553		57.22% Pervious Area
1,909		42.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 5S: TD-1B



Summary for Subcatchment 6.1S: East driveway

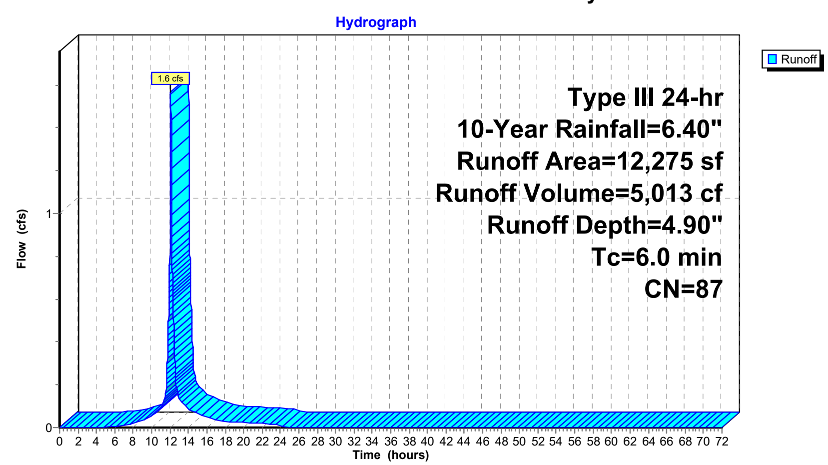
Runoff = 1.6 cfs @ 12.09 hrs, Volume= 5,013 cf, Depth= 4.90"
Routed to Pond 3P : Rain garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
5,611	74	>75% Grass cover, Good, HSG C
6,444	98	Paved roads w/curbs & sewers, HSG C
220	89	Gravel roads, HSG C
12,275	87	Weighted Average
5,831		47.50% Pervious Area
6,444		52.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 6.1S: East driveway



Summary for Subcatchment 6S: Bypass Towards Wetlands

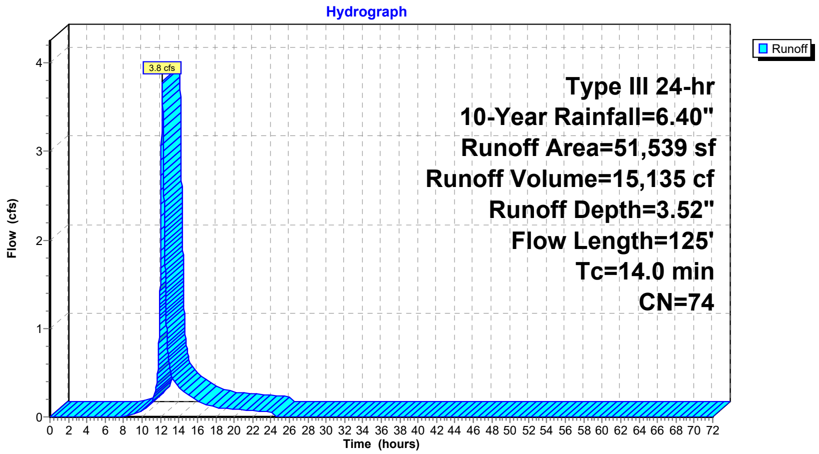
Runoff = 3.8 cfs @ 12.19 hrs, Volume= 15,135 cf, Depth= 3.52"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
4,985	70	Woods, Good, HSG C
46,447	74	>75% Grass cover, Good, HSG C
107	98	Roofs, HSG C
51,539	74	Weighted Average
51,432		99.79% Pervious Area
107		0.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	50	0.0220	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
2.2	75	0.0133	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	125	Total			

Subcatchment 6S: Bypass Towards Wetlands



Summary for Subcatchment 7S: To Street

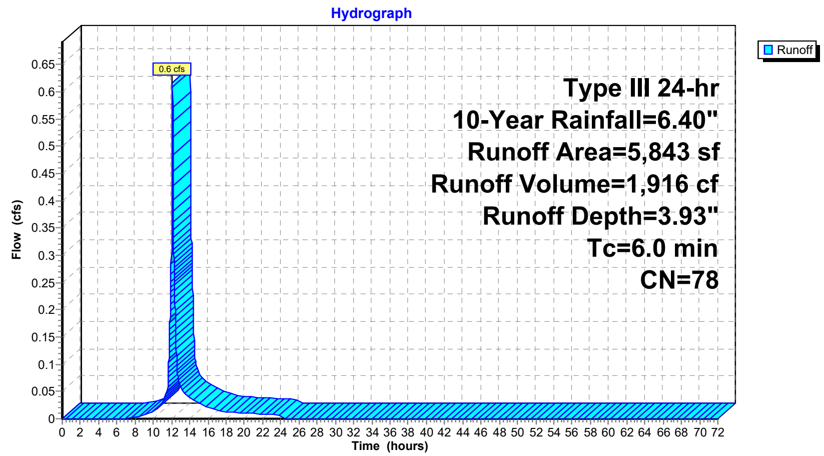
Runoff = 0.6 cfs @ 12.09 hrs, Volume= 1,916 cf, Depth= 3.93"
Routed to Link 2L : Towards Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=6.40"

Area (sf)	CN	Description
1,056	98	Paved parking, HSG C
4,787	74	>75% Grass cover, Good, HSG C
5,843	78	Weighted Average
4,787		81.93% Pervious Area
1,056		18.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 7S: To Street



Summary for Pond 1P: Inf Syst-1

Inflow Area = 60,436 sf, 85.36% Impervious, Inflow Depth = 5.61" for 10-Year event
Inflow = 8.0 cfs @ 12.09 hrs, Volume= 28,251 cf
Outflow = 2.3 cfs @ 12.43 hrs, Volume= 28,251 cf, Atten= 71%, Lag= 20.8 min
Discarded = 0.1 cfs @ 6.13 hrs, Volume= 14,540 cf
Primary = 2.2 cfs @ 12.43 hrs, Volume= 13,710 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.96' @ 12.43 hrs Surf.Area= 7,459 sf Storage= 12,545 cf

Plug-Flow detention time= 442.3 min calculated for 28,251 cf (100% of inflow)
Center-of-Mass det. time= 442.2 min (1,198.8 - 756.6)

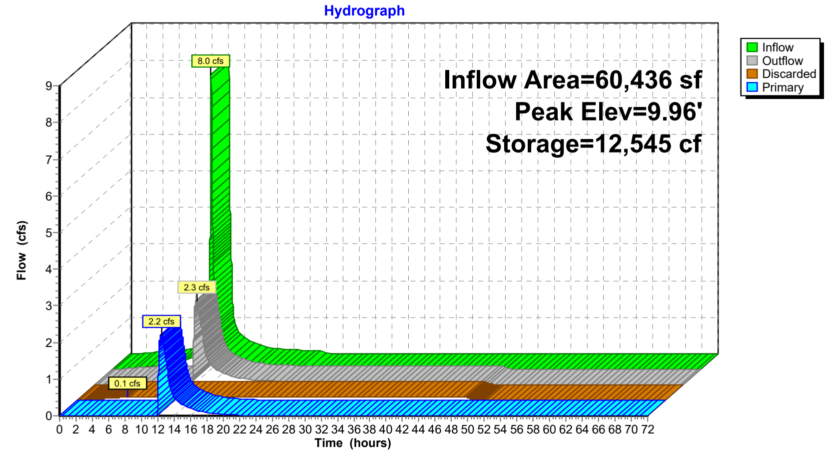
Volume	Invert	Avail.Storage	Storage Description
#1	8.00'	19,245 cf	**6.89'W x 14.06'L x 3.00'H StormTrap ST-1 Units (Irregular Shape)** x 77 22,378 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	8.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	8.00'	**15.0" Round Culvert** L= 26.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 8.00' / 7.13' S= 0.0335 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#3	Device 2	9.22'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	10.05'	**20.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 2	10.79'	**3.7' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.1 cfs @ 6.13 hrs HW=8.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=2.2 cfs @ 12.43 hrs HW=9.96' (Free Discharge)
└─**2=Culvert** (Passes 2.2 cfs of 6.8 cfs potential flow)
  ├─**3=Orifice/Grate** (Orifice Controls 2.2 cfs @ 3.62 fps)
  ├─**4=Orifice/Grate** (Controls 0.0 cfs)
  └─**5=Sharp-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 1P: Inf Syst-1



Summary for Pond 3P: Rain garden

Inflow Area = 12,275 sf, 52.50% Impervious, Inflow Depth = 4.90" for 10-Year event
Inflow = 1.6 cfs @ 12.09 hrs, Volume= 5,013 cf
Outflow = 1.6 cfs @ 12.09 hrs, Volume= 5,013 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.0 cfs @ 12.09 hrs, Volume= 477 cf
Primary = 1.6 cfs @ 12.09 hrs, Volume= 4,537 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 6.45' @ 12.09 hrs Surf.Area= 429 sf Storage= 229 cf

Plug-Flow detention time= 53.5 min calculated for 5,012 cf (100% of inflow)
Center-of-Mass det. time= 53.6 min (846.0 - 792.4)

Volume	Invert	Avail.Storage	Storage Description
#1	5.60'	253 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

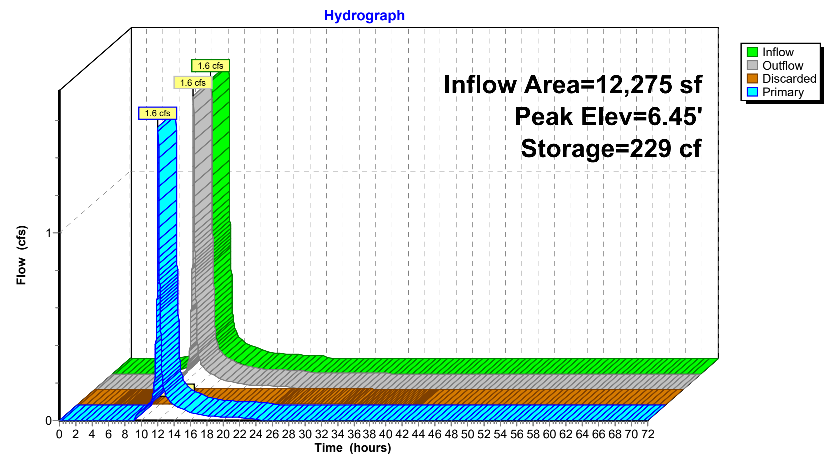
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.60	125	46.0	0	0	125
6.00	276	66.0	78	78	305
6.30	350	73.0	94	172	385
6.50	460	87.0	81	253	564

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.60'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	6.35'	**22.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.0 cfs @ 12.09 hrs HW=6.45' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=1.6 cfs @ 12.09 hrs HW=6.45' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 1.6 cfs @ 0.73 fps)

Pond 3P: Rain garden



Summary for Pond 4P: Inf Syst-2

Inflow Area = 1,112 sf, 95.68% Impervious, Inflow Depth = 6.04" for 10-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 560 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 547 cf, Atten= 1%, Lag= 0.6 min
Discarded = 0.0 cfs @ 2.79 hrs, Volume= 159 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 388 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.47' @ 12.09 hrs Surf.Area= 101 sf Storage= 131 cf

Plug-Flow detention time= 483.5 min calculated for 546 cf (98% of inflow)
Center-of-Mass det. time= 468.6 min (1,219.5 - 751.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A**
			274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1
			Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf
			Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf
			10 Chambers in 2 Rows
		141 cf	Total Available Storage

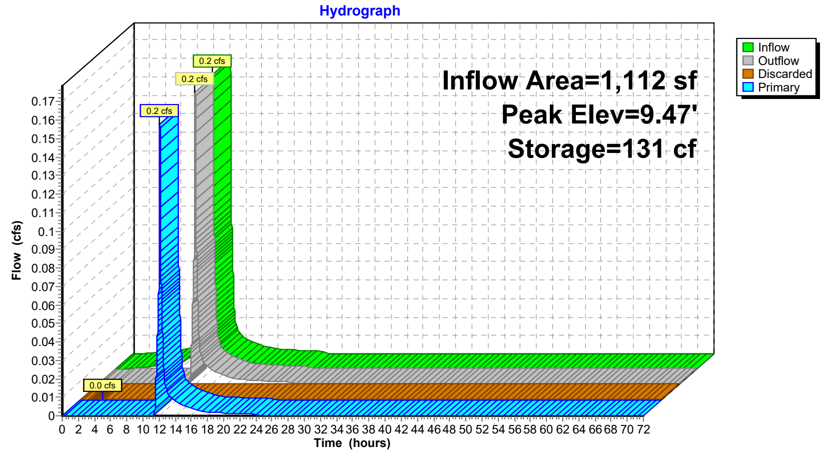
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.23'	**6.0" Round Culvert**
			L= 33.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 9.23' / 8.72' S= 0.0155 '/' Cc= 0.900
			n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 2.79 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.47' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.2 cfs @ 1.67 fps)

Pond 4P: Inf Syst-2



Summary for Pond 5P: Inf Syst-3

Inflow Area = 1,105 sf, 97.29% Impervious, Inflow Depth = 6.04" for 10-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 556 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 537 cf, Atten= 1%, Lag= 0.6 min
Discarded = 0.0 cfs @ 2.83 hrs, Volume= 159 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 379 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.61' @ 12.09 hrs Surf.Area= 101 sf Storage= 137 cf

Plug-Flow detention time= 497.7 min calculated for 537 cf (97% of inflow)
Center-of-Mass det. time= 476.9 min (1,227.8 - 751.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A**
			274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1
			Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf
			Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf
			10 Chambers in 2 Rows
		141 cf	Total Available Storage

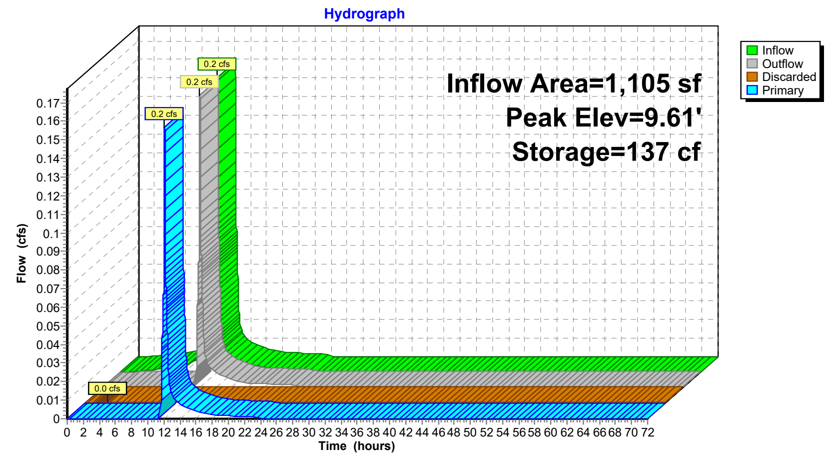
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.37'	**6.0" Round Culvert**
			L= 33.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 9.37' / 8.73' S= 0.0194 '/' Cc= 0.900
			n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 2.83 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.61' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.2 cfs @ 1.67 fps)

Pond 5P: Inf Syst-3



Summary for Pond 6P: Inf Syst-4

Inflow Area = 1,104 sf, 97.46% Impervious, Inflow Depth = 6.04" for 10-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 556 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 537 cf, Atten= 1%, Lag= 0.6 min
Discarded = 0.0 cfs @ 2.83 hrs, Volume= 159 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 378 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.61' @ 12.09 hrs Surf.Area= 101 sf Storage= 137 cf

Plug-Flow detention time= 498.4 min calculated for 537 cf (97% of inflow)
Center-of-Mass det. time= 477.3 min (1,228.2 - 751.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A**
			274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1
			Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf
			Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf
			10 Chambers in 2 Rows
		141 cf	Total Available Storage

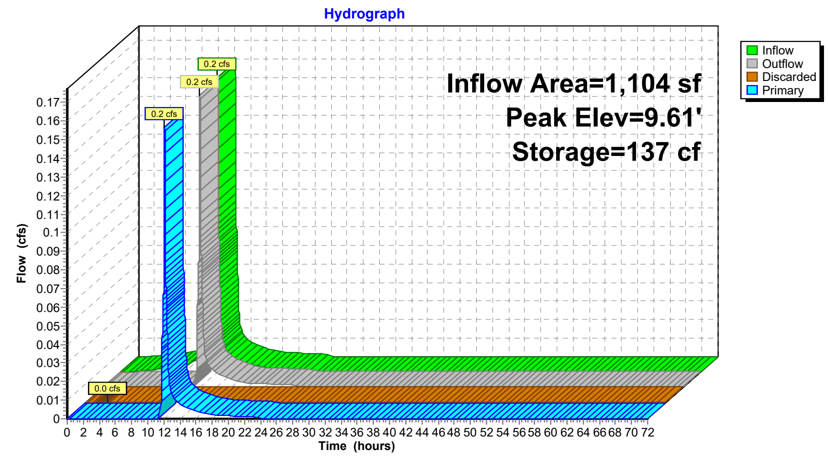
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.37'	**6.0" Round Culvert**
			L= 51.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 9.37' / 8.10' S= 0.0249 '/' Cc= 0.900
			n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 2.83 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.61' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.2 cfs @ 1.67 fps)

Pond 6P: Inf Syst-4



Summary for Pond 7P: Inf Syst-5

Inflow Area = 1,082 sf, 98.06% Impervious, Inflow Depth = 6.16" for 10-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 556 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 555 cf, Atten= 1%, Lag= 0.6 min
Discarded = 0.0 cfs @ 2.12 hrs, Volume= 160 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 395 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.24' @ 12.09 hrs Surf.Area= 101 sf Storage= 119 cf

Plug-Flow detention time= 464.5 min calculated for 555 cf (100% of inflow)
Center-of-Mass det. time= 463.9 min (1,208.1 - 744.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A**
			241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1
			Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf
			Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf
			10 Chambers in 2 Rows
		125 cf	Total Available Storage

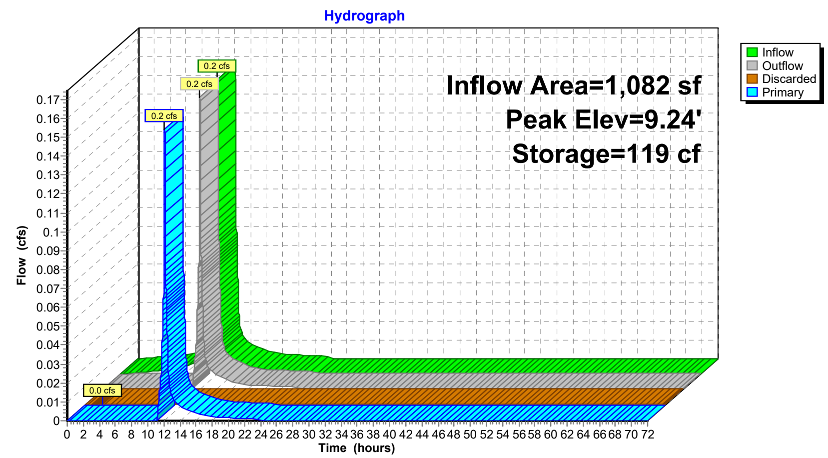
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**6.0" Round Culvert**
			L= 48.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 9.00' / 8.35' S= 0.0135 '/' Cc= 0.900
			n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 2.12 hrs HW=7.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.24' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.2 cfs @ 1.66 fps)

Pond 7P: Inf Syst-5



Summary for Pond 8P: Inf Syst-6

Inflow Area = 1,056 sf, 99.24% Impervious, Inflow Depth = 6.16" for 10-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 542 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 541 cf, Atten= 1%, Lag= 0.6 min
Discarded = 0.0 cfs @ 2.19 hrs, Volume= 160 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 382 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.26' @ 12.09 hrs Surf.Area= 101 sf Storage= 120 cf

Plug-Flow detention time= 475.6 min calculated for 541 cf (100% of inflow)
Center-of-Mass det. time= 474.9 min (1,219.1 - 744.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A** 241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1 Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf 10 Chambers in 2 Rows
		125 cf	Total Available Storage

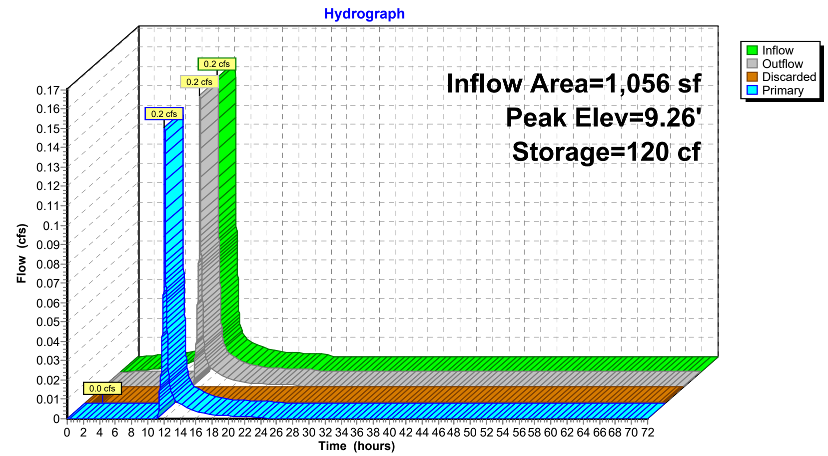
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**8.0" Round Culvert** L= 46.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.00' / 8.77' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 2.19 hrs HW=7.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.1 cfs @ 12.09 hrs HW=9.26' (Free Discharge)
└**2=Culvert** (Barrel Controls 0.1 cfs @ 1.80 fps)

Pond 8P: Inf Syst-6



Summary for Pond 9P: Inf Syst-7

Inflow Area = 24,131 sf, 72.87% Impervious, Inflow Depth = 5.37" for 10-Year event
Inflow = 3.3 cfs @ 12.08 hrs, Volume= 10,797 cf
Outflow = 2.1 cfs @ 12.18 hrs, Volume= 10,797 cf, Atten= 37%, Lag= 5.7 min
Discarded = 0.0 cfs @ 5.84 hrs, Volume= 1,502 cf
Primary = 2.1 cfs @ 12.18 hrs, Volume= 9,295 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 8.14' @ 12.18 hrs Surf.Area= 2,422 sf Storage= 2,069 cf

Plug-Flow detention time= 63.5 min calculated for 10,795 cf (100% of inflow)
Center-of-Mass det. time= 63.5 min (841.9 - 778.3)

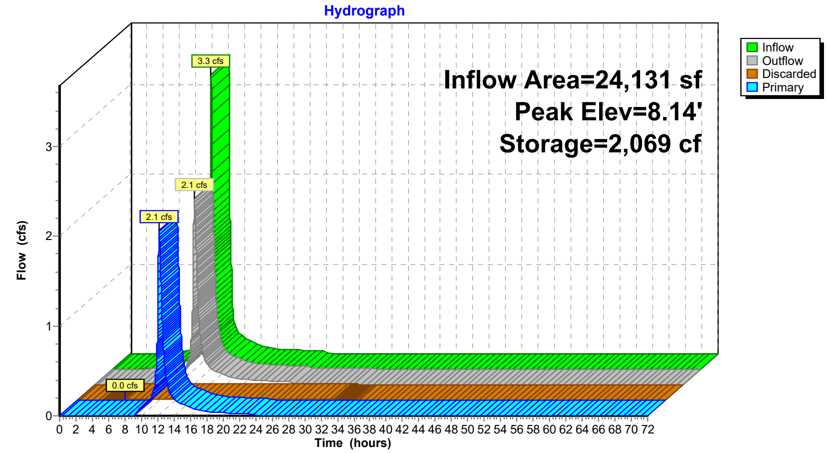
Volume	Invert	Avail.Storage	Storage Description
#1	7.15'	3,645 cf	**6.89'W x 14.06'L x 1.75'H StormTrap ST-1 Units (Irregular Shape)** x 25 4,238 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.15'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	7.15'	**12.0" Round Culvert** L= 4.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.15' / 7.13' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	7.35'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 5.84 hrs HW=7.17' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=2.1 cfs @ 12.18 hrs HW=8.14' (Free Discharge)
└─**2=Culvert** (Barrel Controls 2.1 cfs @ 3.29 fps)
  └─**3=Orifice/Grate** (Passes 2.1 cfs of 2.3 cfs potential flow)

Pond 9P: Inf Syst-7

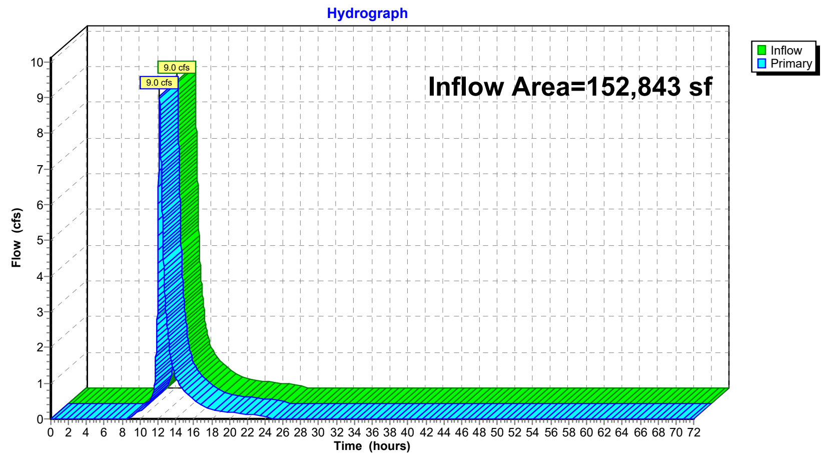


Summary for Link 1L: Towards Wetlands

Inflow Area = 152,843 sf, 50.79% Impervious, Inflow Depth = 3.48" for 10-Year event
Inflow = 9.0 cfs @ 12.18 hrs, Volume= 44,377 cf
Primary = 9.0 cfs @ 12.18 hrs, Volume= 44,377 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 1L: Towards Wetlands

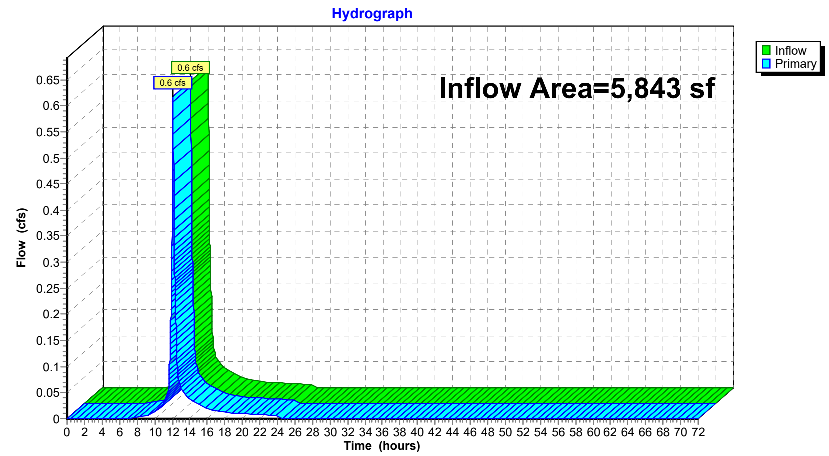


Summary for Link 2L: Towards Street

Inflow Area = 5,843 sf, 18.07% Impervious, Inflow Depth = 3.93" for 10-Year event
Inflow = 0.6 cfs @ 12.09 hrs, Volume= 1,916 cf
Primary = 0.6 cfs @ 12.09 hrs, Volume= 1,916 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 2L: Towards Street

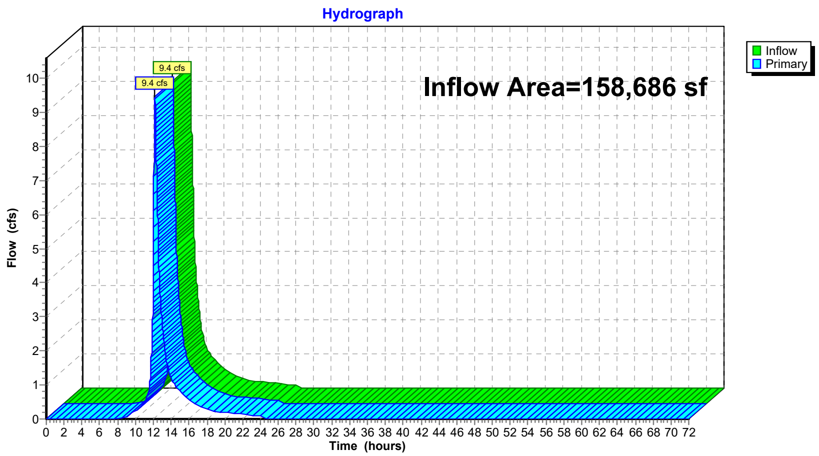


Summary for Link 100L: Total Flows

Inflow Area =	158,686 sf, 49.59% Impervious, Inflow Depth = 3.50"	for 10-Year event
Inflow =	9.4 cfs @ 12.17 hrs, Volume=	46,293 cf
Primary =	9.4 cfs @ 12.17 hrs, Volume=	46,293 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 100L: Total Flows



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: CB-1 Runoff Area=22,742 sf 72.16% Impervious Runoff Depth=7.22"
Tc=6.0 min CN=91 Runoff=4.1 cfs 13,685 cf

Subcatchment2S: Building Roof Runoff Area=32,925 sf 100.00% Impervious Runoff Depth=8.06"
Tc=6.0 min CN=98 Runoff=6.2 cfs 22,115 cf

Subcatchment3.1S: Backyard ADs Runoff Area=8,985 sf 3.03% Impervious Runoff Depth=5.31"
Flow Length=147' Tc=10.3 min CN=75 Runoff=1.1 cfs 3,978 cf

Subcatchment3S: Townhouse Roofs Runoff Area=13,067 sf 100.00% Impervious Runoff Depth=8.06"
Tc=6.0 min CN=98 Runoff=2.4 cfs 8,777 cf

Subcatchment4.2S: TD-2 Runoff Area=1,112 sf 95.68% Impervious Runoff Depth=7.94"
Tc=6.0 min CN=97 Runoff=0.2 cfs 736 cf

Subcatchment4.3S: TD-3 Runoff Area=1,105 sf 97.29% Impervious Runoff Depth=7.94"
Tc=6.0 min CN=97 Runoff=0.2 cfs 731 cf

Subcatchment4.4S: TD-4 Runoff Area=1,104 sf 97.46% Impervious Runoff Depth=7.94"
Tc=6.0 min CN=97 Runoff=0.2 cfs 730 cf

Subcatchment4.5S: TD-5 Runoff Area=1,082 sf 98.06% Impervious Runoff Depth=8.06"
Tc=6.0 min CN=98 Runoff=0.2 cfs 727 cf

Subcatchment4.6S: TD-6 Runoff Area=1,056 sf 99.24% Impervious Runoff Depth=8.06"
Tc=6.0 min CN=98 Runoff=0.2 cfs 709 cf

Subcatchment5.1S: TD-1A Runoff Area=1,389 sf 84.59% Impervious Runoff Depth=7.58"
Tc=6.0 min CN=94 Runoff=0.3 cfs 877 cf

Subcatchment5S: TD-1B Runoff Area=4,462 sf 42.78% Impervious Runoff Depth=6.38"
Tc=6.0 min CN=84 Runoff=0.7 cfs 2,374 cf

Subcatchment6.1S: East driveway Runoff Area=12,275 sf 52.50% Impervious Runoff Depth=6.74"
Tc=6.0 min CN=87 Runoff=2.1 cfs 6,897 cf

Subcatchment6S: Bypass Towards Runoff Area=51,539 sf 0.21% Impervious Runoff Depth=5.19"
Flow Length=125' Tc=14.0 min CN=74 Runoff=5.6 cfs 22,311 cf

Subcatchment7S: To Street Runoff Area=5,843 sf 18.07% Impervious Runoff Depth=5.67"
Tc=6.0 min CN=78 Runoff=0.9 cfs 2,760 cf

Pond 1P: Inf Syst-1 Peak Elev=10.41' Storage=15,470 cf Inflow=10.6 cfs 37,649 cf
Discarded=0.1 cfs 14,969 cf Primary=4.1 cfs 22,680 cf Outflow=4.2 cfs 37,649 cf

Pond 3P: Rain garden Peak Elev=6.47' Storage=239 cf Inflow=2.1 cfs 6,897 cf
Discarded=0.0 cfs 495 cf Primary=2.1 cfs 6,401 cf Outflow=2.1 cfs 6,897 cf

Pond 4P: Inf Syst-2 Peak Elev=9.51' Storage=133 cf Inflow=0.2 cfs 736 cf
Discarded=0.0 cfs 160 cf Primary=0.2 cfs 562 cf Outflow=0.2 cfs 722 cf

Pond 5P: Inf Syst-3 Peak Elev=9.65' Storage=139 cf Inflow=0.2 cfs 731 cf
Discarded=0.0 cfs 160 cf Primary=0.2 cfs 552 cf Outflow=0.2 cfs 712 cf

Pond 6P: Inf Syst-4 Peak Elev=9.65' Storage=139 cf Inflow=0.2 cfs 730 cf
Discarded=0.0 cfs 160 cf Primary=0.2 cfs 552 cf Outflow=0.2 cfs 711 cf

Pond 7P: Inf Syst-5 Peak Elev=9.28' Storage=121 cf Inflow=0.2 cfs 727 cf
Discarded=0.0 cfs 161 cf Primary=0.2 cfs 565 cf Outflow=0.2 cfs 726 cf

Pond 8P: Inf Syst-6 Peak Elev=9.29' Storage=122 cf Inflow=0.2 cfs 709 cf
Discarded=0.0 cfs 161 cf Primary=0.2 cfs 548 cf Outflow=0.2 cfs 708 cf

Pond 9P: Inf Syst-7 Peak Elev=8.38' Storage=2,562 cf Inflow=4.3 cfs 14,562 cf
Discarded=0.0 cfs 1,561 cf Primary=2.7 cfs 13,001 cf Outflow=2.7 cfs 14,562 cf

Link 1L: Towards Wetlands Inflow=13.7 cfs 66,767 cf
Primary=13.7 cfs 66,767 cf

Link 2L: Towards Street Inflow=0.9 cfs 2,760 cf
Primary=0.9 cfs 2,760 cf

Link 100L: Total Flows Inflow=14.2 cfs 69,527 cf
Primary=14.2 cfs 69,527 cf

Total Runoff Area = 158,686 sf Runoff Volume = 87,407 cf Average Runoff Depth = 6.61"
50.41% Pervious = 79,997 sf 49.59% Impervious = 78,689 sf

Summary for Subcatchment 1S: CB-1

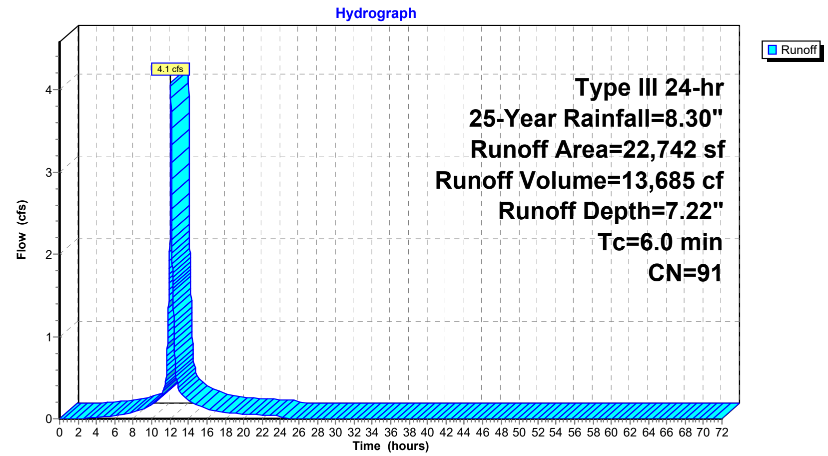
Runoff = 4.1 cfs @ 12.08 hrs, Volume= 13,685 cf, Depth= 7.22"
Routed to Pond 9P : Inf Syst-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
16,410	98	Paved parking, HSG C
6,332	74	>75% Grass cover, Good, HSG C
22,742	91	Weighted Average
6,332		27.84% Pervious Area
16,410		72.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 1S: CB-1



Summary for Subcatchment 2S: Building Roof

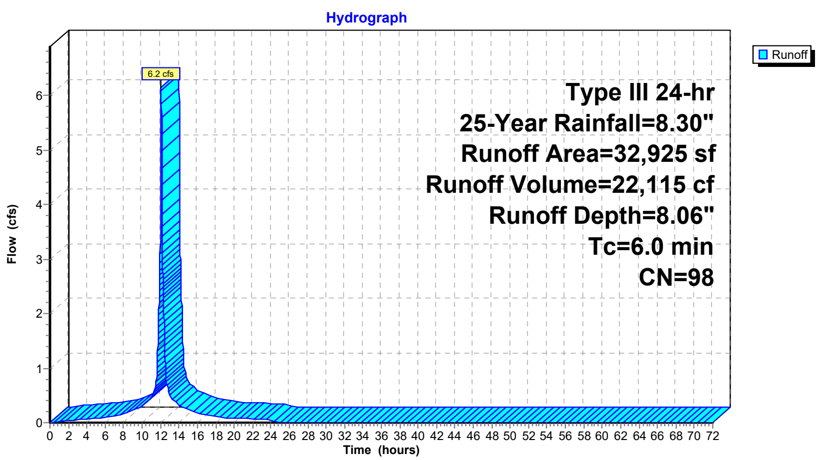
Runoff = 6.2 cfs @ 12.08 hrs, Volume= 22,115 cf, Depth= 8.06"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
32,925	98	Roofs, HSG C
32,925		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 2S: Building Roof



Summary for Subcatchment 3.1S: Backyard ADs

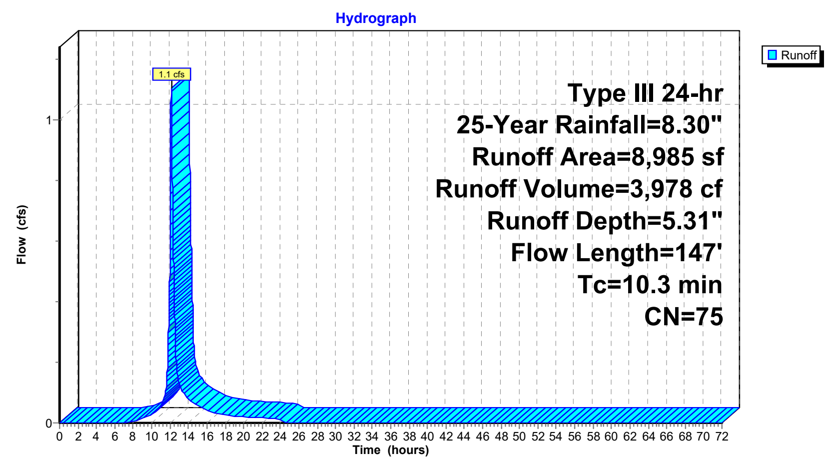
Runoff = 1.1 cfs @ 12.14 hrs, Volume= 3,978 cf, Depth= 5.31"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

	Area (sf)	CN	Description
	272	98	Unconnected pavement, HSG C
	8,302	74	>75% Grass cover, Good, HSG C
*	411	89	Gravel sidewalk, HSG C
	8,985	75	Weighted Average
	8,713		96.97% Pervious Area
	272		3.03% Impervious Area
	272		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	50	0.0142	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.23"
0.9	97	0.0154	1.86		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
10.3	147	Total			

Subcatchment 3.1S: Backyard ADs



Summary for Subcatchment 3S: Townhouse Roofs

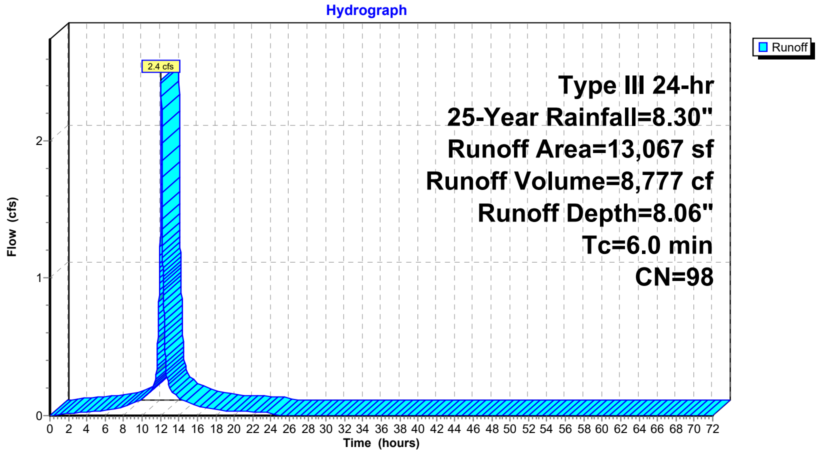
Runoff = 2.4 cfs @ 12.08 hrs, Volume= 8,777 cf, Depth= 8.06"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
13,067	98	Roofs, HSG C
13,067		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 3S: Townhouse Roofs



Summary for Subcatchment 4.2S: TD-2

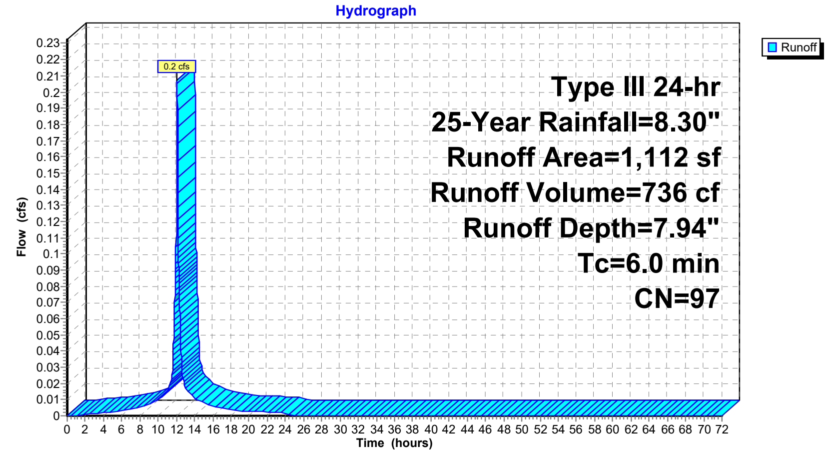
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 736 cf, Depth= 7.94"
Routed to Pond 4P : Inf Syst-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
1,064	98	Paved parking, HSG C
48	74	>75% Grass cover, Good, HSG C
1,112	97	Weighted Average
48		4.32% Pervious Area
1,064		95.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.2S: TD-2



Summary for Subcatchment 4.3S: TD-3

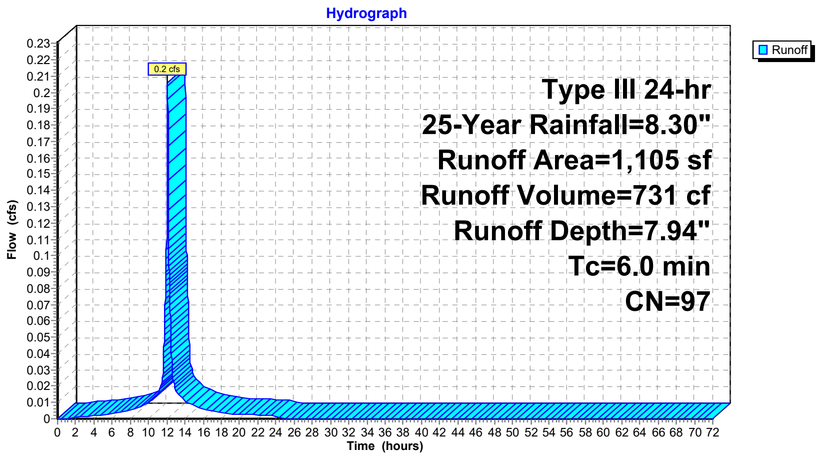
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 731 cf, Depth= 7.94"
Routed to Pond 5P : Inf Syst-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
1,075	98	Paved parking, HSG C
30	74	>75% Grass cover, Good, HSG C
1,105	97	Weighted Average
30		2.71% Pervious Area
1,075		97.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.3S: TD-3



Summary for Subcatchment 4.4S: TD-4

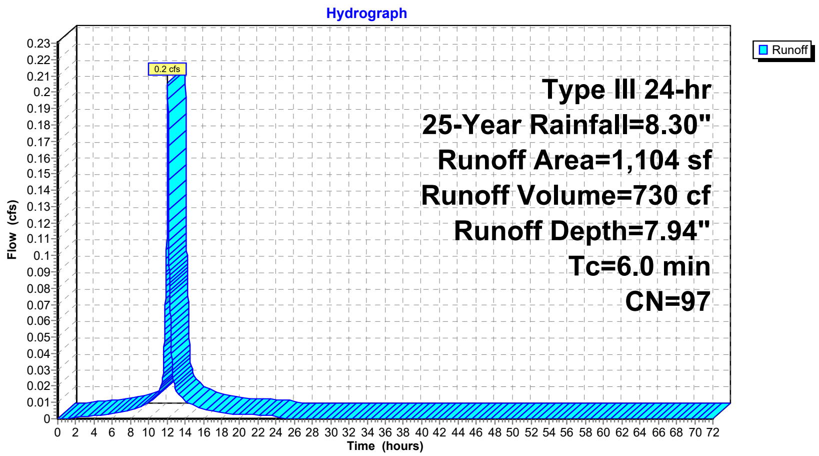
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 730 cf, Depth= 7.94"
Routed to Pond 6P : Inf Syst-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
1,076	98	Paved parking, HSG C
28	74	>75% Grass cover, Good, HSG C
1,104	97	Weighted Average
28		2.54% Pervious Area
1,076		97.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.4S: TD-4



Summary for Subcatchment 4.5S: TD-5

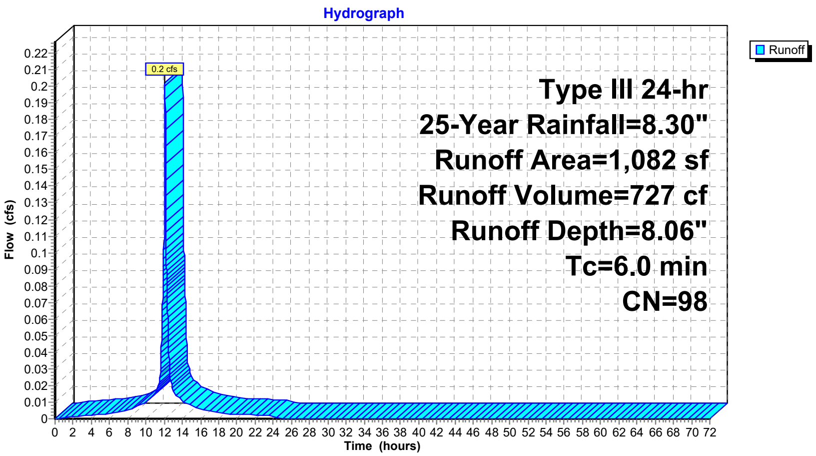
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 727 cf, Depth= 8.06"
Routed to Pond 7P : Inf Syst-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
1,061	98	Paved parking, HSG C
21	74	>75% Grass cover, Good, HSG C
1,082	98	Weighted Average
21		1.94% Pervious Area
1,061		98.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.5S: TD-5



Summary for Subcatchment 4.6S: TD-6

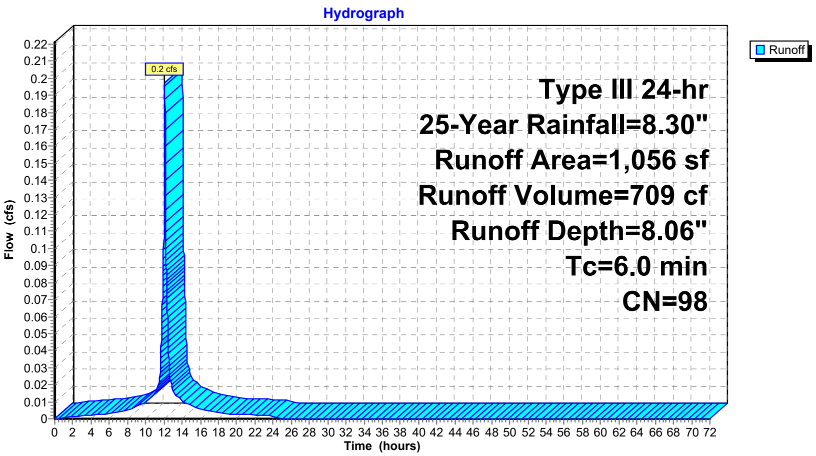
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 709 cf, Depth= 8.06"
Routed to Pond 8P : Inf Syst-6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
1,048	98	Paved parking, HSG C
8	74	>75% Grass cover, Good, HSG C
1,056	98	Weighted Average
8		0.76% Pervious Area
1,048		99.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.6S: TD-6



Summary for Subcatchment 5.1S: TD-1A

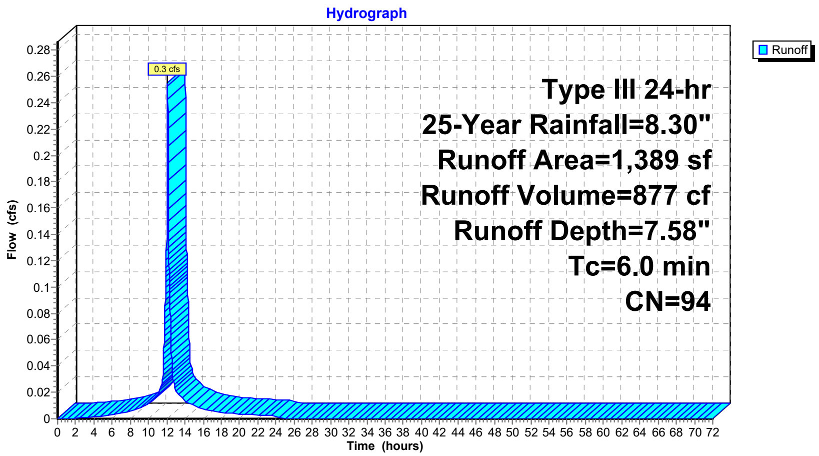
Runoff = 0.3 cfs @ 12.08 hrs, Volume= 877 cf, Depth= 7.58"
Routed to Pond 9P : Inf Syst-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
1,175	98	Paved parking, HSG C
214	74	>75% Grass cover, Good, HSG C
1,389	94	Weighted Average
214		15.41% Pervious Area
1,175		84.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 5.1S: TD-1A



Summary for Subcatchment 5S: TD-1B

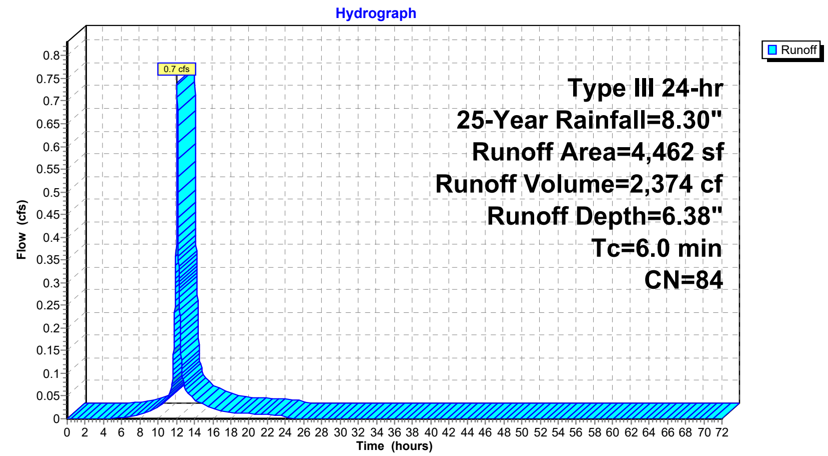
Runoff = 0.7 cfs @ 12.09 hrs, Volume= 2,374 cf, Depth= 6.38"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
1,909	98	Paved parking, HSG C
2,553	74	>75% Grass cover, Good, HSG C
4,462	84	Weighted Average
2,553		57.22% Pervious Area
1,909		42.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 5S: TD-1B



Summary for Subcatchment 6.1S: East driveway

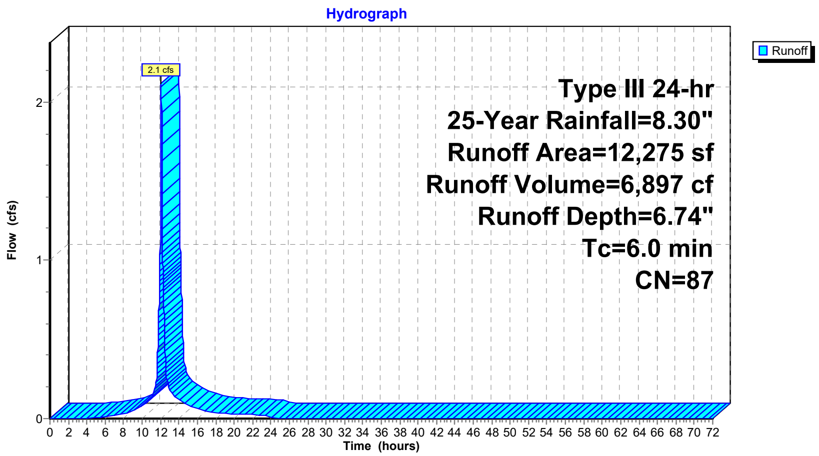
Runoff = 2.1 cfs @ 12.08 hrs, Volume= 6,897 cf, Depth= 6.74"
Routed to Pond 3P : Rain garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
5,611	74	>75% Grass cover, Good, HSG C
6,444	98	Paved roads w/curbs & sewers, HSG C
220	89	Gravel roads, HSG C
12,275	87	Weighted Average
5,831		47.50% Pervious Area
6,444		52.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 6.1S: East driveway



Summary for Subcatchment 6S: Bypass Towards Wetlands

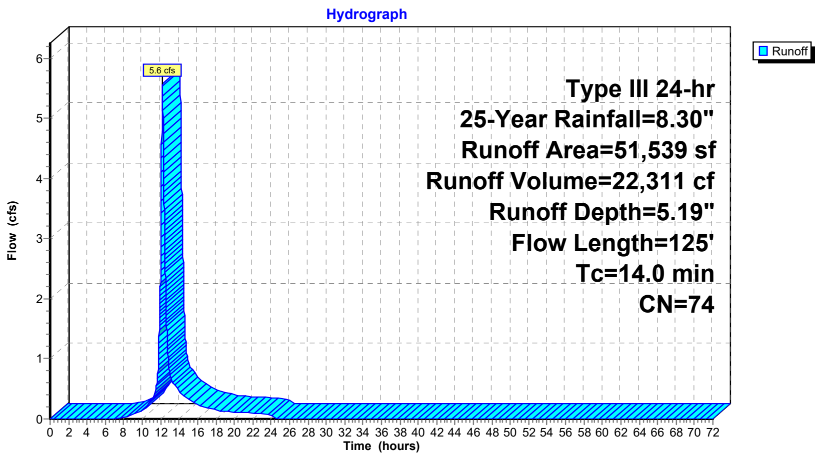
Runoff = 5.6 cfs @ 12.19 hrs, Volume= 22,311 cf, Depth= 5.19"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
4,985	70	Woods, Good, HSG C
46,447	74	>75% Grass cover, Good, HSG C
107	98	Roofs, HSG C
51,539	74	Weighted Average
51,432		99.79% Pervious Area
107		0.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	50	0.0220	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
2.2	75	0.0133	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	125	Total			

Subcatchment 6S: Bypass Towards Wetlands



Summary for Subcatchment 7S: To Street

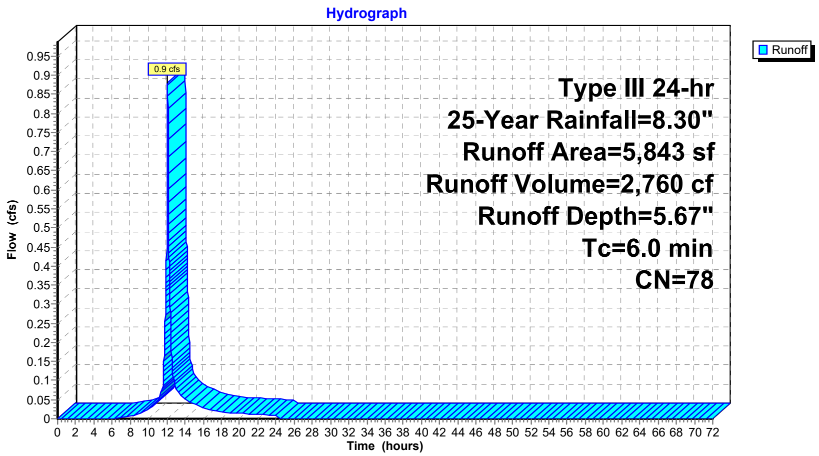
Runoff = 0.9 cfs @ 12.09 hrs, Volume= 2,760 cf, Depth= 5.67"
Routed to Link 2L : Towards Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=8.30"

Area (sf)	CN	Description
1,056	98	Paved parking, HSG C
4,787	74	>75% Grass cover, Good, HSG C
5,843	78	Weighted Average
4,787		81.93% Pervious Area
1,056		18.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 7S: To Street



Summary for Pond 1P: Inf Syst-1

Inflow Area = 60,436 sf, 85.36% Impervious, Inflow Depth = 7.48" for 25-Year event
Inflow = 10.6 cfs @ 12.09 hrs, Volume= 37,649 cf
Outflow = 4.2 cfs @ 12.32 hrs, Volume= 37,649 cf, Atten= 60%, Lag= 14.1 min
Discarded = 0.1 cfs @ 4.33 hrs, Volume= 14,969 cf
Primary = 4.1 cfs @ 12.32 hrs, Volume= 22,680 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 10.41' @ 12.32 hrs Surf.Area= 7,459 sf Storage= 15,470 cf

Plug-Flow detention time= 354.1 min calculated for 37,649 cf (100% of inflow)
Center-of-Mass det. time= 354.1 min (1,107.3 - 753.2)

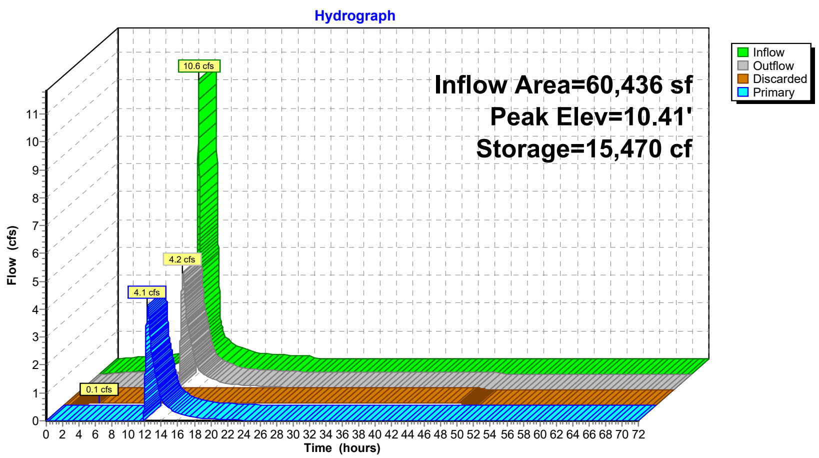
Volume	Invert	Avail.Storage	Storage Description
#1	8.00'	19,245 cf	**6.89'W x 14.06'L x 3.00'H StormTrap ST-1 Units (Irregular Shape)** x 77 22,378 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	8.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	8.00'	**15.0" Round Culvert** L= 26.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 8.00' / 7.13' S= 0.0335 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#3	Device 2	9.22'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	10.05'	**20.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 2	10.79'	**3.7' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.1 cfs @ 4.33 hrs HW=8.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=4.1 cfs @ 12.32 hrs HW=10.41' (Free Discharge)
└─**2=Culvert** (Passes 4.1 cfs of 7.9 cfs potential flow)
  ├─**3=Orifice/Grate** (Orifice Controls 3.0 cfs @ 4.87 fps)
  ├─**4=Orifice/Grate** (Orifice Controls 1.1 cfs @ 2.05 fps)
  └─**5=Sharp-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 1P: Inf Syst-1



Summary for Pond 3P: Rain garden

Inflow Area = 12,275 sf, 52.50% Impervious, Inflow Depth = 6.74" for 25-Year event
Inflow = 2.1 cfs @ 12.08 hrs, Volume= 6,897 cf
Outflow = 2.1 cfs @ 12.09 hrs, Volume= 6,897 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.0 cfs @ 12.09 hrs, Volume= 495 cf
Primary = 2.1 cfs @ 12.09 hrs, Volume= 6,401 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 6.47' @ 12.09 hrs Surf.Area= 442 sf Storage= 239 cf

Plug-Flow detention time= 40.9 min calculated for 6,896 cf (100% of inflow)
Center-of-Mass det. time= 41.0 min (824.8 - 783.8)

Volume	Invert	Avail.Storage	Storage Description
#1	5.60'	253 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

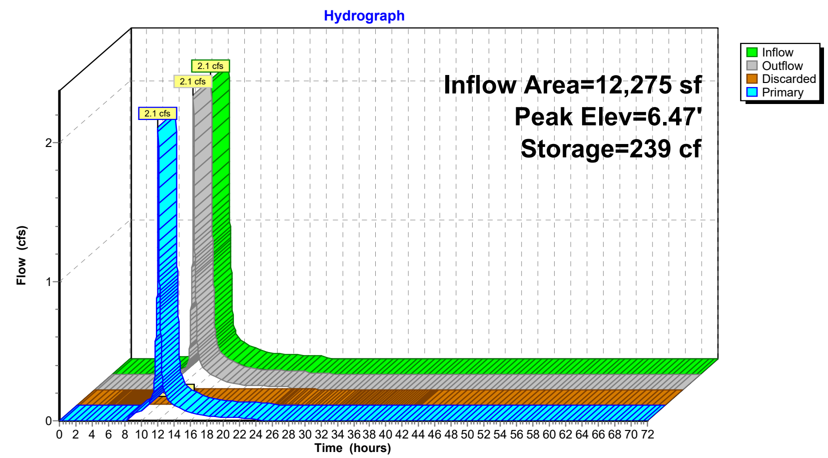
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.60	125	46.0	0	0	125
6.00	276	66.0	78	78	305
6.30	350	73.0	94	172	385
6.50	460	87.0	81	253	564

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.60'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	6.35'	**22.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.0 cfs @ 12.09 hrs HW=6.47' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=2.1 cfs @ 12.09 hrs HW=6.47' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 2.1 cfs @ 0.81 fps)

Pond 3P: Rain garden



Summary for Pond 4P: Inf Syst-2

Inflow Area = 1,112 sf, 95.68% Impervious, Inflow Depth = 7.94" for 25-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 736 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 722 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 2.05 hrs, Volume= 160 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 562 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.51' @ 12.09 hrs Surf.Area= 101 sf Storage= 133 cf

Plug-Flow detention time= 377.3 min calculated for 722 cf (98% of inflow)
Center-of-Mass det. time= 365.7 min (1,112.2 - 746.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

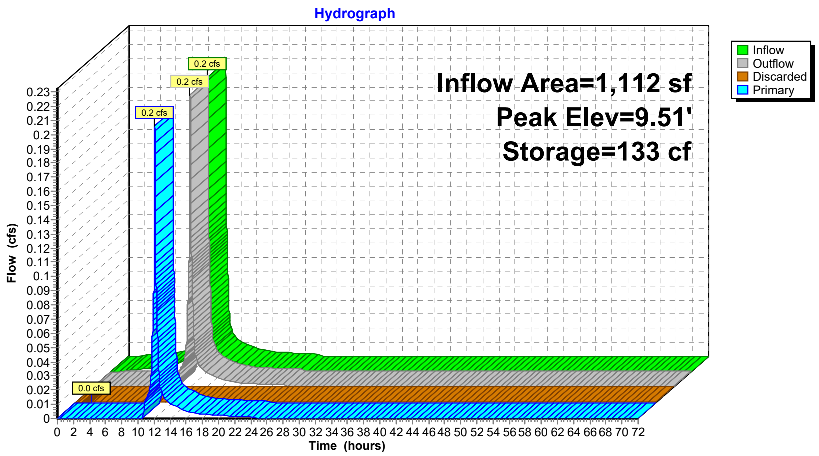
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.23'	**6.0" Round Culvert** L= 33.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.23' / 8.72' S= 0.0155 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 2.05 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.51' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.2 cfs @ 1.81 fps)

Pond 4P: Inf Syst-2



Summary for Pond 5P: Inf Syst-3

Inflow Area = 1,105 sf, 97.29% Impervious, Inflow Depth = 7.94" for 25-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 731 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 712 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 2.08 hrs, Volume= 160 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 552 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.65' @ 12.09 hrs Surf.Area= 101 sf Storage= 139 cf

Plug-Flow detention time= 388.2 min calculated for 712 cf (97% of inflow)
Center-of-Mass det. time= 371.5 min (1,118.0 - 746.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

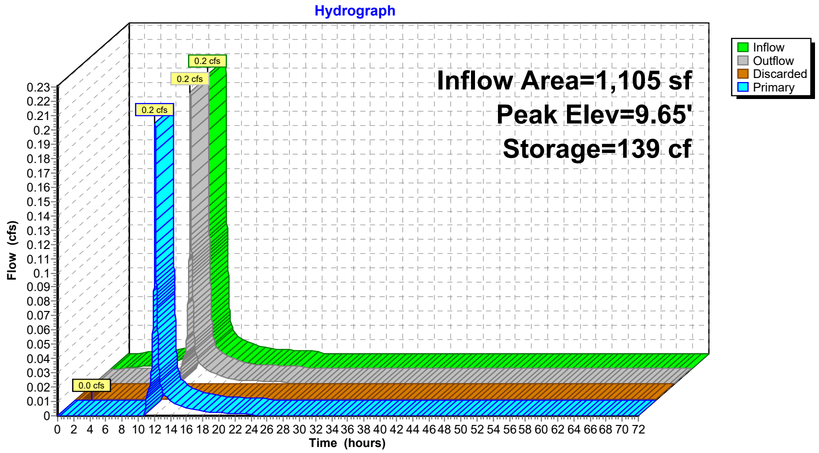
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.37'	**6.0" Round Culvert** L= 33.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.37' / 8.73' S= 0.0194 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 2.08 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.65' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.2 cfs @ 1.80 fps)

Pond 5P: Inf Syst-3



Summary for Pond 6P: Inf Syst-4

Inflow Area = 1,104 sf, 97.46% Impervious, Inflow Depth = 7.94" for 25-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 730 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 711 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 2.08 hrs, Volume= 160 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 552 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.65' @ 12.09 hrs Surf.Area= 101 sf Storage= 139 cf

Plug-Flow detention time= 388.1 min calculated for 711 cf (97% of inflow)
Center-of-Mass det. time= 371.8 min (1,118.4 - 746.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

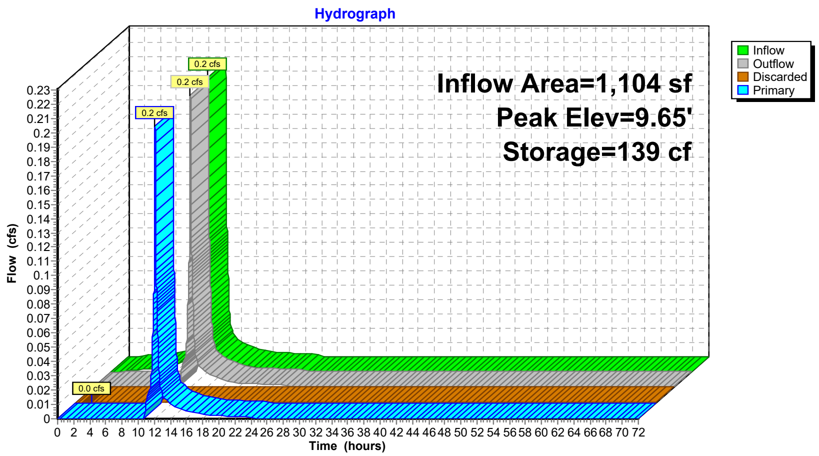
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.37'	**6.0" Round Culvert** L= 51.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.37' / 8.10' S= 0.0249 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 2.08 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.65' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.2 cfs @ 1.80 fps)

Pond 6P: Inf Syst-4



Summary for Pond 7P: Inf Syst-5

Inflow Area = 1,082 sf, 98.06% Impervious, Inflow Depth = 8.06" for 25-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 727 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 726 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.52 hrs, Volume= 161 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 565 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.28' @ 12.09 hrs Surf.Area= 101 sf Storage= 121 cf

Plug-Flow detention time= 365.7 min calculated for 726 cf (100% of inflow)
Center-of-Mass det. time= 365.2 min (1,106.0 - 740.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A** 241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1 Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf 10 Chambers in 2 Rows
		125 cf	Total Available Storage

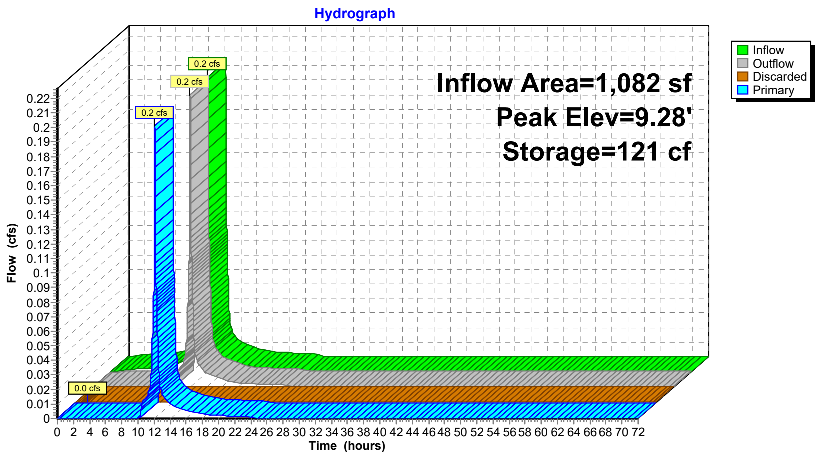
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**6.0" Round Culvert** L= 48.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.00' / 8.35' S= 0.0135 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 1.52 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.28' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.2 cfs @ 1.79 fps)

Pond 7P: Inf Syst-5



Summary for Pond 8P: Inf Syst-6

Inflow Area = 1,056 sf, 99.24% Impervious, Inflow Depth = 8.06" for 25-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 709 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 708 cf, Atten= 1%, Lag= 0.6 min
Discarded = 0.0 cfs @ 1.56 hrs, Volume= 161 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 548 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.29' @ 12.09 hrs Surf.Area= 101 sf Storage= 122 cf

Plug-Flow detention time= 374.4 min calculated for 708 cf (100% of inflow)
Center-of-Mass det. time= 373.8 min (1,114.6 - 740.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A**
			241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1
			Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf
			Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf
			10 Chambers in 2 Rows
		125 cf	Total Available Storage

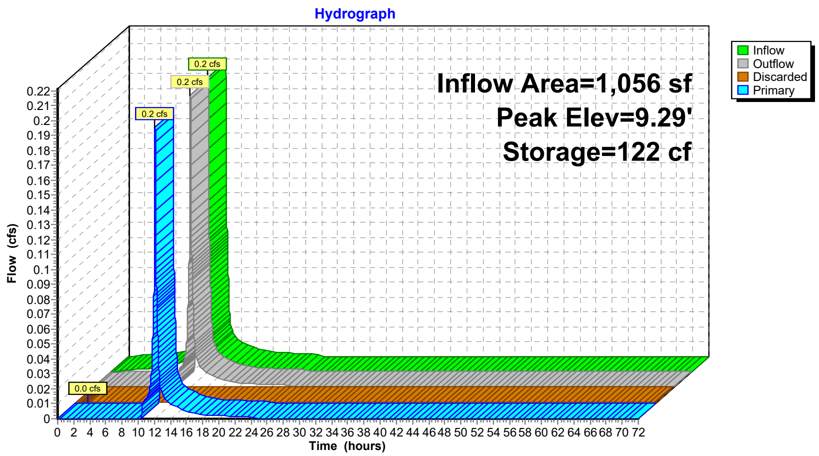
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**8.0" Round Culvert**
			L= 46.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 9.00' / 8.77' S= 0.0050 '/' Cc= 0.900
			n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 1.56 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.29' (Free Discharge)
└─**2=Culvert** (Barrel Controls 0.2 cfs @ 1.94 fps)

Pond 8P: Inf Syst-6



Summary for Pond 9P: Inf Syst-7

Inflow Area = 24,131 sf, 72.87% Impervious, Inflow Depth = 7.24" for 25-Year event
Inflow = 4.3 cfs @ 12.08 hrs, Volume= 14,562 cf
Outflow = 2.7 cfs @ 12.18 hrs, Volume= 14,562 cf, Atten= 37%, Lag= 5.7 min
Discarded = 0.0 cfs @ 4.62 hrs, Volume= 1,561 cf
Primary = 2.7 cfs @ 12.18 hrs, Volume= 13,001 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 8.38' @ 12.18 hrs Surf.Area= 2,422 sf Storage= 2,562 cf

Plug-Flow detention time= 53.2 min calculated for 14,562 cf (100% of inflow)
Center-of-Mass det. time= 53.1 min (824.0 - 770.9)

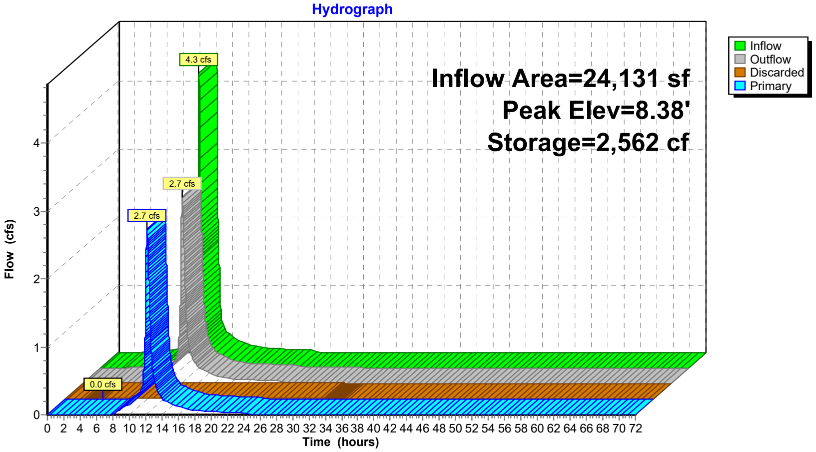
Volume	Invert	Avail.Storage	Storage Description
#1	7.15'	3,645 cf	**6.89'W x 14.06'L x 1.75'H StormTrap ST-1 Units (Irregular Shape)** x 25 4,238 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.15'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	7.15'	**12.0" Round Culvert** L= 4.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.15' / 7.13' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	7.35'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 4.62 hrs HW=7.17' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=2.7 cfs @ 12.18 hrs HW=8.38' (Free Discharge)
└**2=Culvert** (Passes 2.7 cfs of 2.7 cfs potential flow)
└**3=Orifice/Grate** (Orifice Controls 2.7 cfs @ 4.47 fps)

Pond 9P: Inf Syst-7

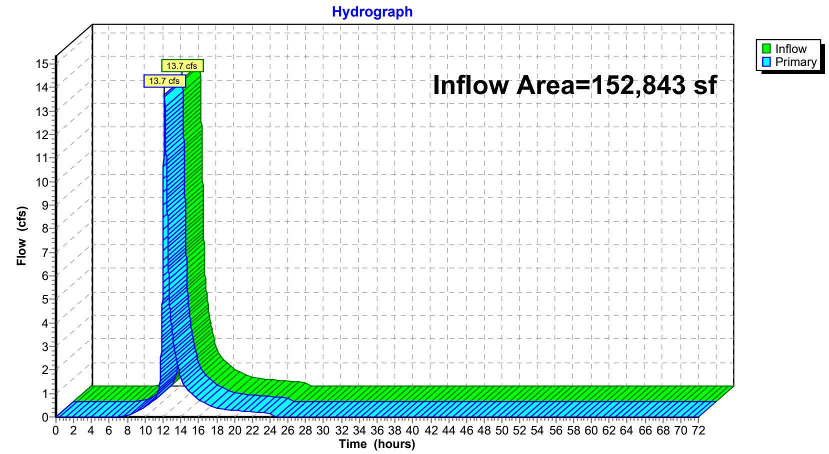


Summary for Link 1L: Towards Wetlands

Inflow Area = 152,843 sf, 50.79% Impervious, Inflow Depth = 5.24" for 25-Year event
Inflow = 13.7 cfs @ 12.18 hrs, Volume= 66,767 cf
Primary = 13.7 cfs @ 12.18 hrs, Volume= 66,767 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 1L: Towards Wetlands

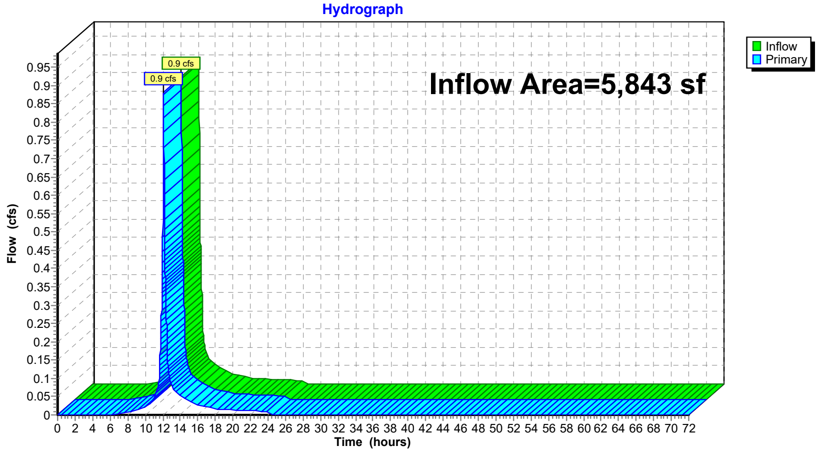


Summary for Link 2L: Towards Street

Inflow Area = 5,843 sf, 18.07% Impervious, Inflow Depth = 5.67" for 25-Year event
Inflow = 0.9 cfs @ 12.09 hrs, Volume= 2,760 cf
Primary = 0.9 cfs @ 12.09 hrs, Volume= 2,760 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 2L: Towards Street

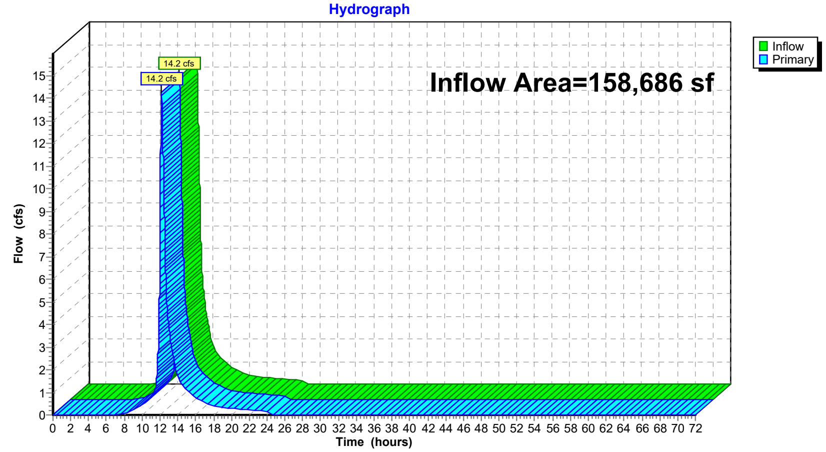


Summary for Link 100L: Total Flows

Inflow Area = 158,686 sf, 49.59% Impervious, Inflow Depth = 5.26" for 25-Year event
Inflow = 14.2 cfs @ 12.18 hrs, Volume= 69,527 cf
Primary = 14.2 cfs @ 12.18 hrs, Volume= 69,527 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 100L: Total Flows



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: CB-1 Runoff Area=22,742 sf 72.16% Impervious Runoff Depth=8.58"
Tc=6.0 min CN=91 Runoff=4.8 cfs 16,254 cf

Subcatchment2S: Building Roof Runoff Area=32,925 sf 100.00% Impervious Runoff Depth=9.43"
Tc=6.0 min CN=98 Runoff=7.2 cfs 25,872 cf

Subcatchment3.1S: Backyard ADs Runoff Area=8,985 sf 3.03% Impervious Runoff Depth=6.57"
Flow Length=147' Tc=10.3 min CN=75 Runoff=1.4 cfs 4,920 cf

Subcatchment3S: Townhouse Roofs Runoff Area=13,067 sf 100.00% Impervious Runoff Depth=9.43"
Tc=6.0 min CN=98 Runoff=2.9 cfs 10,268 cf

Subcatchment4.2S: TD-2 Runoff Area=1,112 sf 95.68% Impervious Runoff Depth=9.31"
Tc=6.0 min CN=97 Runoff=0.2 cfs 863 cf

Subcatchment4.3S: TD-3 Runoff Area=1,105 sf 97.29% Impervious Runoff Depth=9.31"
Tc=6.0 min CN=97 Runoff=0.2 cfs 857 cf

Subcatchment4.4S: TD-4 Runoff Area=1,104 sf 97.46% Impervious Runoff Depth=9.31"
Tc=6.0 min CN=97 Runoff=0.2 cfs 856 cf

Subcatchment4.5S: TD-5 Runoff Area=1,082 sf 98.06% Impervious Runoff Depth=9.43"
Tc=6.0 min CN=98 Runoff=0.2 cfs 850 cf

Subcatchment4.6S: TD-6 Runoff Area=1,056 sf 99.24% Impervious Runoff Depth=9.43"
Tc=6.0 min CN=98 Runoff=0.2 cfs 830 cf

Subcatchment5.1S: TD-1A Runoff Area=1,389 sf 84.59% Impervious Runoff Depth=8.94"
Tc=6.0 min CN=94 Runoff=0.3 cfs 1,035 cf

Subcatchment5S: TD-1B Runoff Area=4,462 sf 42.78% Impervious Runoff Depth=7.71"
Tc=6.0 min CN=84 Runoff=0.9 cfs 2,866 cf

Subcatchment6.1S: East driveway Runoff Area=12,275 sf 52.50% Impervious Runoff Depth=8.08"
Tc=6.0 min CN=87 Runoff=2.5 cfs 8,268 cf

Subcatchment6S: Bypass Towards Runoff Area=51,539 sf 0.21% Impervious Runoff Depth=6.44"
Flow Length=125' Tc=14.0 min CN=74 Runoff=6.9 cfs 27,672 cf

Subcatchment7S: To Street Runoff Area=5,843 sf 18.07% Impervious Runoff Depth=6.95"
Tc=6.0 min CN=78 Runoff=1.1 cfs 3,385 cf

Pond 1P: Inf Syst-1 Peak Elev=10.70' Storage=17,296 cf Inflow=12.4 cfs 44,458 cf
Discarded=0.1 cfs 15,169 cf Primary=5.2 cfs 29,289 cf Outflow=5.3 cfs 44,458 cf

Pond 3P: Rain garden Peak Elev=6.48' Storage=245 cf Inflow=2.5 cfs 8,268 cf
Discarded=0.0 cfs 506 cf Primary=2.5 cfs 7,762 cf Outflow=2.5 cfs 8,268 cf

Pond 4P: Inf Syst-2 Peak Elev=9.54' Storage=134 cf Inflow=0.2 cfs 863 cf
Discarded=0.0 cfs 160 cf Primary=0.2 cfs 689 cf Outflow=0.2 cfs 849 cf

Pond 5P: Inf Syst-3 Peak Elev=9.68' Storage=140 cf Inflow=0.2 cfs 857 cf
Discarded=0.0 cfs 160 cf Primary=0.2 cfs 678 cf Outflow=0.2 cfs 838 cf

Pond 6P: Inf Syst-4 Peak Elev=9.68' Storage=140 cf Inflow=0.2 cfs 856 cf
Discarded=0.0 cfs 160 cf Primary=0.2 cfs 677 cf Outflow=0.2 cfs 837 cf

Pond 7P: Inf Syst-5 Peak Elev=9.30' Storage=122 cf Inflow=0.2 cfs 850 cf
Discarded=0.0 cfs 161 cf Primary=0.2 cfs 688 cf Outflow=0.2 cfs 849 cf

Pond 8P: Inf Syst-6 Peak Elev=9.32' Storage=123 cf Inflow=0.2 cfs 830 cf
Discarded=0.0 cfs 161 cf Primary=0.2 cfs 668 cf Outflow=0.2 cfs 829 cf

Pond 9P: Inf Syst-7 Peak Elev=8.58' Storage=2,968 cf Inflow=5.1 cfs 17,290 cf
Discarded=0.0 cfs 1,591 cf Primary=3.0 cfs 15,699 cf Outflow=3.0 cfs 17,290 cf

Link 1L: Towards Wetlands Inflow=17.0 cfs 83,287 cf
Primary=17.0 cfs 83,287 cf

Link 2L: Towards Street Inflow=1.1 cfs 3,385 cf
Primary=1.1 cfs 3,385 cf

Link 100L: Total Flows Inflow=17.8 cfs 86,673 cf
Primary=17.8 cfs 86,673 cf

Total Runoff Area = 158,686 sf Runoff Volume = 104,796 cf Average Runoff Depth = 7.92"
50.41% Pervious = 79,997 sf 49.59% Impervious = 78,689 sf

Summary for Subcatchment 1S: CB-1

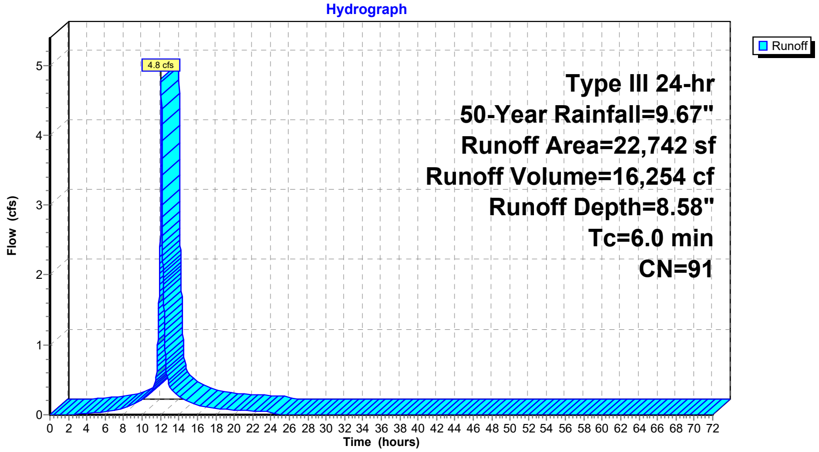
Runoff = 4.8 cfs @ 12.08 hrs, Volume= 16,254 cf, Depth= 8.58"
Routed to Pond 9P : Inf Syst-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
16,410	98	Paved parking, HSG C
6,332	74	>75% Grass cover, Good, HSG C
22,742	91	Weighted Average
6,332		27.84% Pervious Area
16,410		72.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 1S: CB-1



Summary for Subcatchment 2S: Building Roof

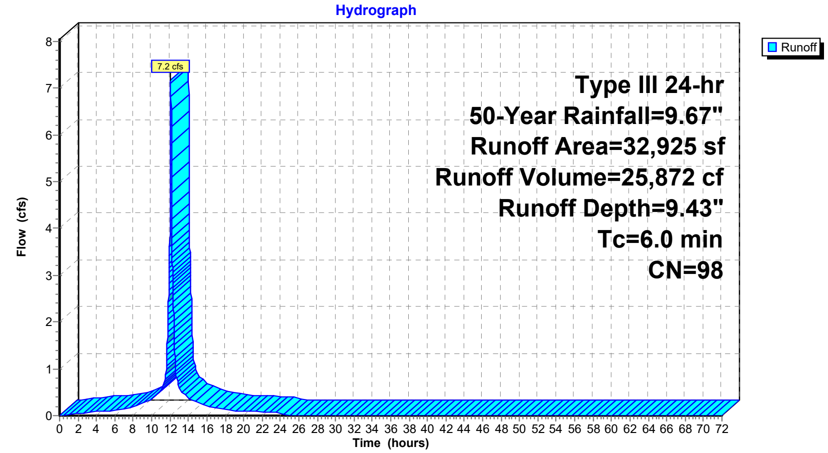
Runoff = 7.2 cfs @ 12.08 hrs, Volume= 25,872 cf, Depth= 9.43"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
32,925	98	Roofs, HSG C
32,925		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 2S: Building Roof



Summary for Subcatchment 3.1S: Backyard ADs

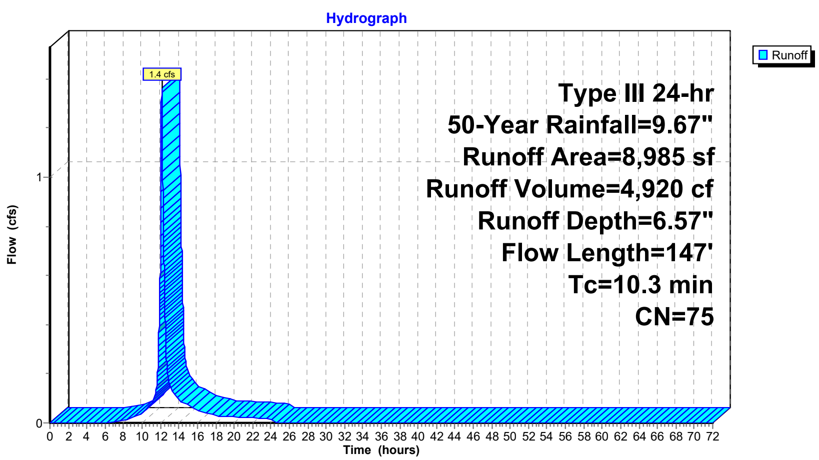
Runoff = 1.4 cfs @ 12.14 hrs, Volume= 4,920 cf, Depth= 6.57"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

	Area (sf)	CN	Description
	272	98	Unconnected pavement, HSG C
	8,302	74	>75% Grass cover, Good, HSG C
*	411	89	Gravel sidewalk, HSG C
	8,985	75	Weighted Average
	8,713		96.97% Pervious Area
	272		3.03% Impervious Area
	272		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	50	0.0142	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.23"
0.9	97	0.0154	1.86		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
10.3	147	Total			

Subcatchment 3.1S: Backyard ADs



Summary for Subcatchment 3S: Townhouse Roofs

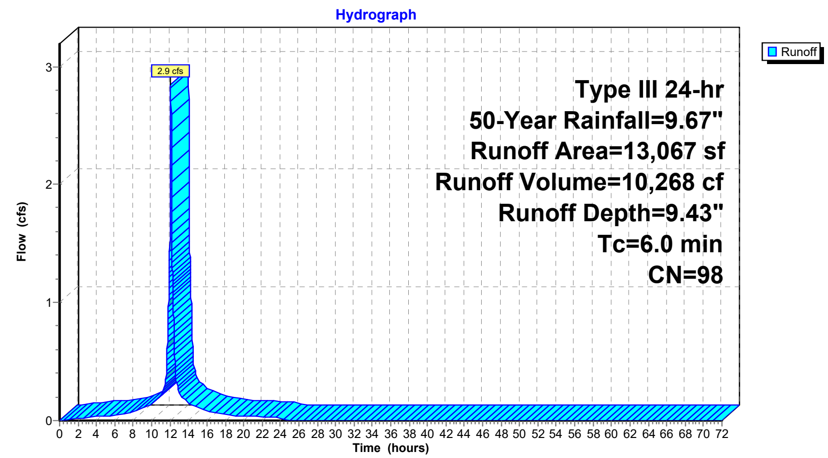
Runoff = 2.9 cfs @ 12.08 hrs, Volume= 10,268 cf, Depth= 9.43"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
13,067	98	Roofs, HSG C
13,067		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 3S: Townhouse Roofs



Summary for Subcatchment 4.2S: TD-2

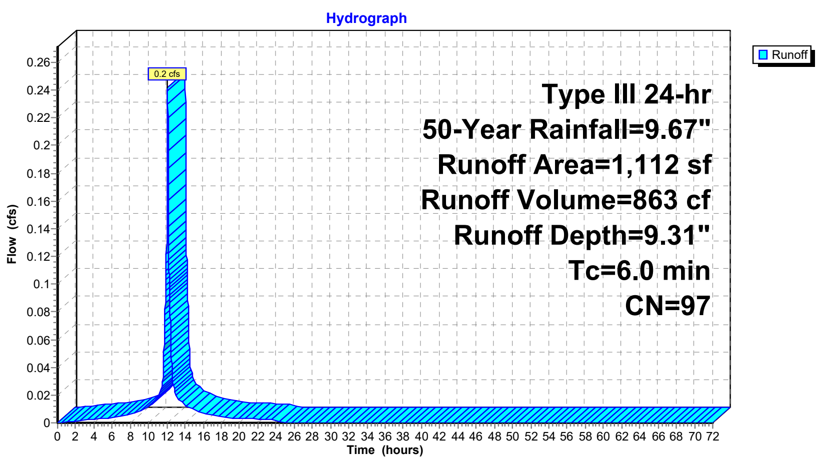
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 863 cf, Depth= 9.31"
Routed to Pond 4P : Inf Syst-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
1,064	98	Paved parking, HSG C
48	74	>75% Grass cover, Good, HSG C
1,112	97	Weighted Average
48		4.32% Pervious Area
1,064		95.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.2S: TD-2



Summary for Subcatchment 4.3S: TD-3

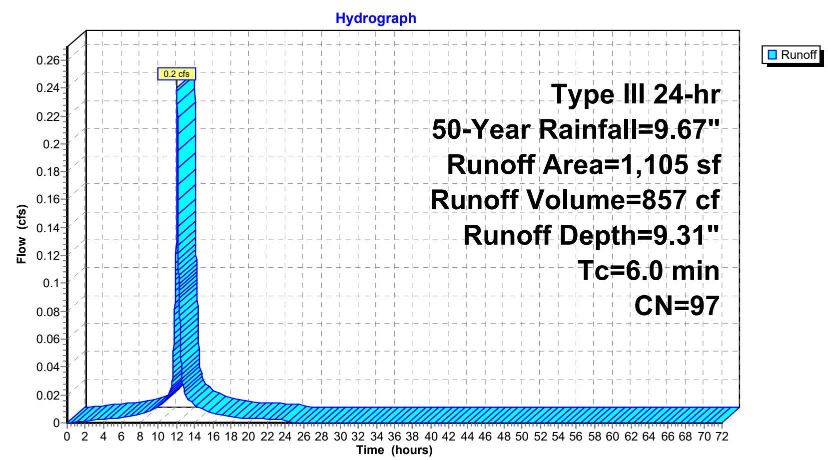
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 857 cf, Depth= 9.31"
Routed to Pond 5P : Inf Syst-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
1,075	98	Paved parking, HSG C
30	74	>75% Grass cover, Good, HSG C
1,105	97	Weighted Average
30		2.71% Pervious Area
1,075		97.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.3S: TD-3



Summary for Subcatchment 4.4S: TD-4

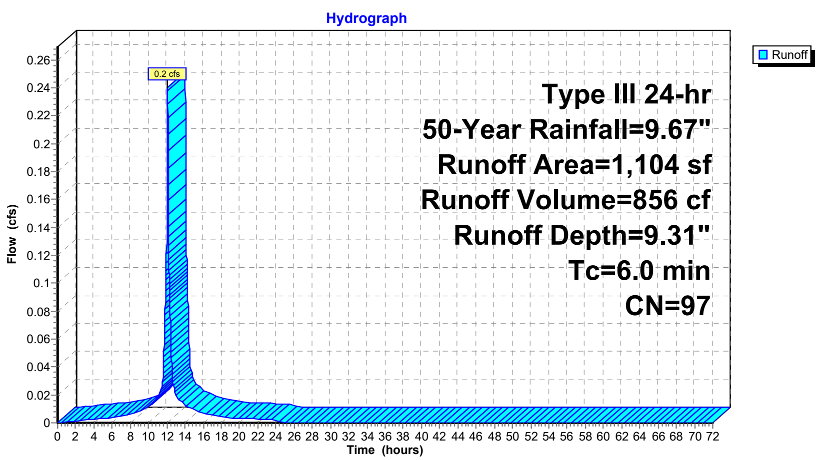
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 856 cf, Depth= 9.31"
Routed to Pond 6P : Inf Syst-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
1,076	98	Paved parking, HSG C
28	74	>75% Grass cover, Good, HSG C
1,104	97	Weighted Average
28		2.54% Pervious Area
1,076		97.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.4S: TD-4



Summary for Subcatchment 4.5S: TD-5

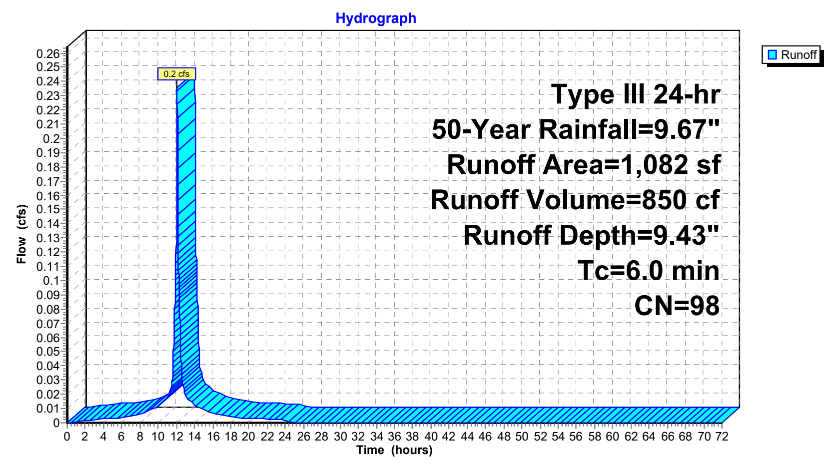
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 850 cf, Depth= 9.43"
Routed to Pond 7P : Inf Syst-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
1,061	98	Paved parking, HSG C
21	74	>75% Grass cover, Good, HSG C
1,082	98	Weighted Average
21		1.94% Pervious Area
1,061		98.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.5S: TD-5



Summary for Subcatchment 4.6S: TD-6

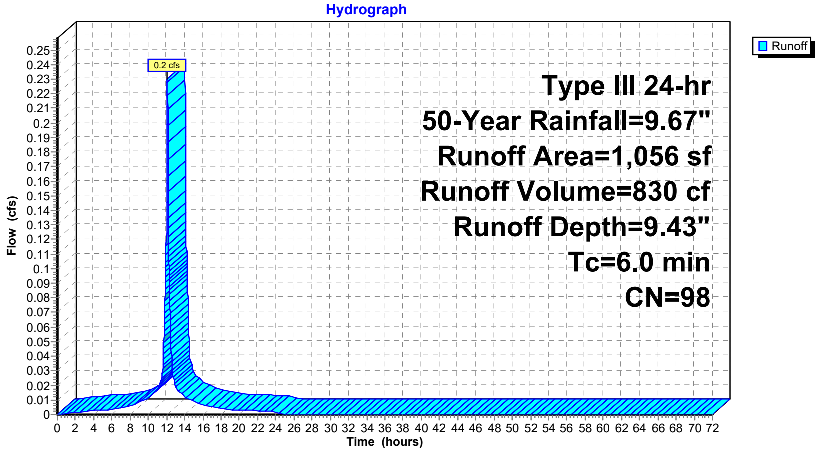
Runoff = 0.2 cfs @ 12.08 hrs, Volume= 830 cf, Depth= 9.43"
Routed to Pond 8P : Inf Syst-6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
1,048	98	Paved parking, HSG C
8	74	>75% Grass cover, Good, HSG C
1,056	98	Weighted Average
8		0.76% Pervious Area
1,048		99.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.6S: TD-6



Summary for Subcatchment 5.1S: TD-1A

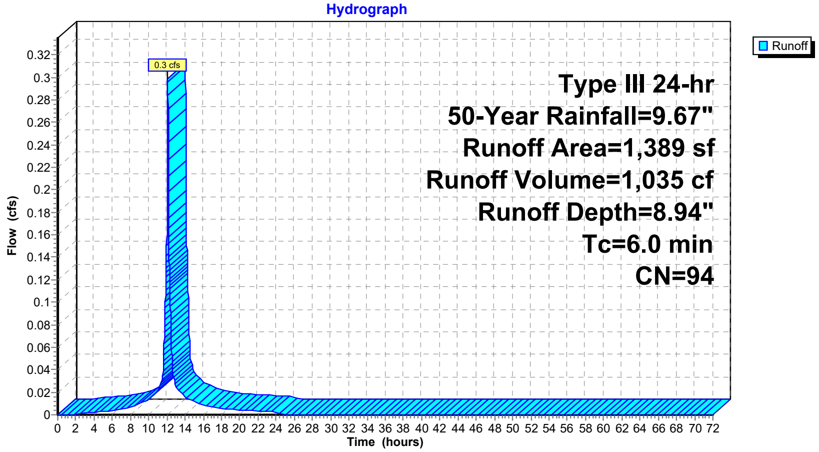
Runoff = 0.3 cfs @ 12.08 hrs, Volume= 1,035 cf, Depth= 8.94"
Routed to Pond 9P : Inf Syst-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
1,175	98	Paved parking, HSG C
214	74	>75% Grass cover, Good, HSG C
1,389	94	Weighted Average
214		15.41% Pervious Area
1,175		84.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 5.1S: TD-1A



Summary for Subcatchment 5S: TD-1B

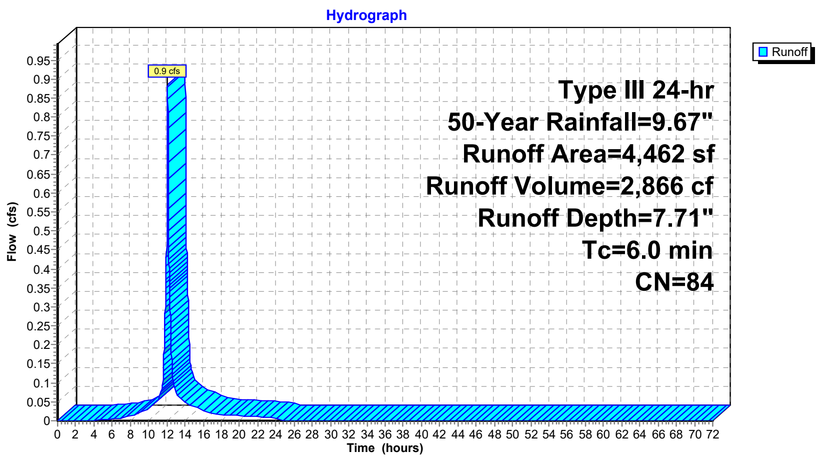
Runoff = 0.9 cfs @ 12.08 hrs, Volume= 2,866 cf, Depth= 7.71"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
1,909	98	Paved parking, HSG C
2,553	74	>75% Grass cover, Good, HSG C
4,462	84	Weighted Average
2,553		57.22% Pervious Area
1,909		42.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 5S: TD-1B



Summary for Subcatchment 6.1S: East driveway

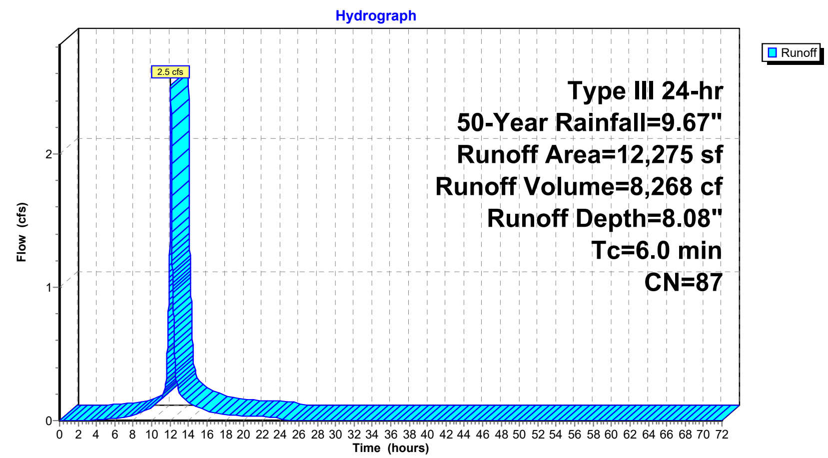
Runoff = 2.5 cfs @ 12.08 hrs, Volume= 8,268 cf, Depth= 8.08"
Routed to Pond 3P : Rain garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
5,611	74	>75% Grass cover, Good, HSG C
6,444	98	Paved roads w/curbs & sewers, HSG C
220	89	Gravel roads, HSG C
12,275	87	Weighted Average
5,831		47.50% Pervious Area
6,444		52.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 6.1S: East driveway



Summary for Subcatchment 6S: Bypass Towards Wetlands

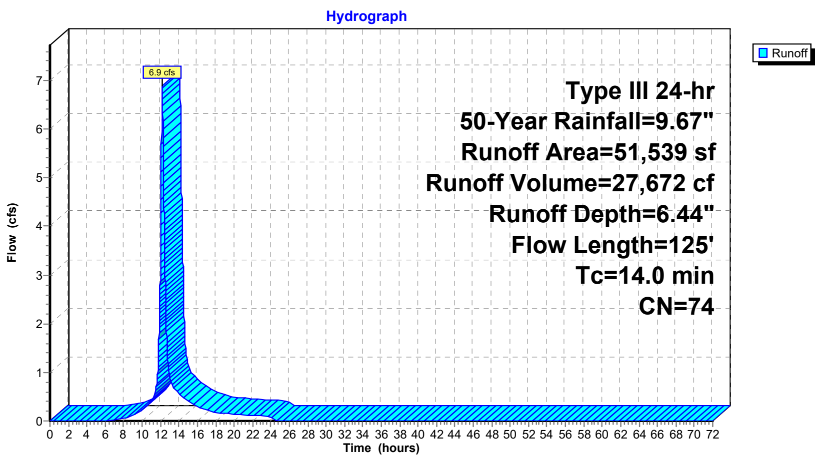
Runoff = 6.9 cfs @ 12.19 hrs, Volume= 27,672 cf, Depth= 6.44"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
4,985	70	Woods, Good, HSG C
46,447	74	>75% Grass cover, Good, HSG C
107	98	Roofs, HSG C
51,539	74	Weighted Average
51,432		99.79% Pervious Area
107		0.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	50	0.0220	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
2.2	75	0.0133	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	125	Total			

Subcatchment 6S: Bypass Towards Wetlands



Summary for Subcatchment 7S: To Street

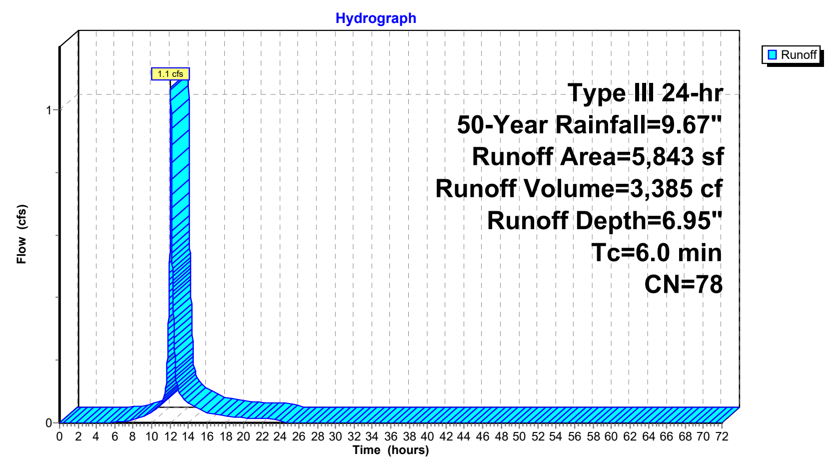
Runoff = 1.1 cfs @ 12.09 hrs, Volume= 3,385 cf, Depth= 6.95"
Routed to Link 2L : Towards Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Year Rainfall=9.67"

Area (sf)	CN	Description
1,056	98	Paved parking, HSG C
4,787	74	>75% Grass cover, Good, HSG C
5,843	78	Weighted Average
4,787		81.93% Pervious Area
1,056		18.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 7S: To Street



Summary for Pond 1P: Inf Syst-1

Inflow Area = 60,436 sf, 85.36% Impervious, Inflow Depth = 8.83" for 50-Year event
Inflow = 12.4 cfs @ 12.09 hrs, Volume= 44,458 cf
Outflow = 5.3 cfs @ 12.30 hrs, Volume= 44,458 cf, Atten= 57%, Lag= 12.5 min
Discarded = 0.1 cfs @ 3.50 hrs, Volume= 15,169 cf
Primary = 5.2 cfs @ 12.30 hrs, Volume= 29,289 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 10.70' @ 12.30 hrs Surf.Area= 7,459 sf Storage= 17,296 cf

Plug-Flow detention time= 312.6 min calculated for 44,458 cf (100% of inflow)
Center-of-Mass det. time= 312.5 min (1,063.8 - 751.2)

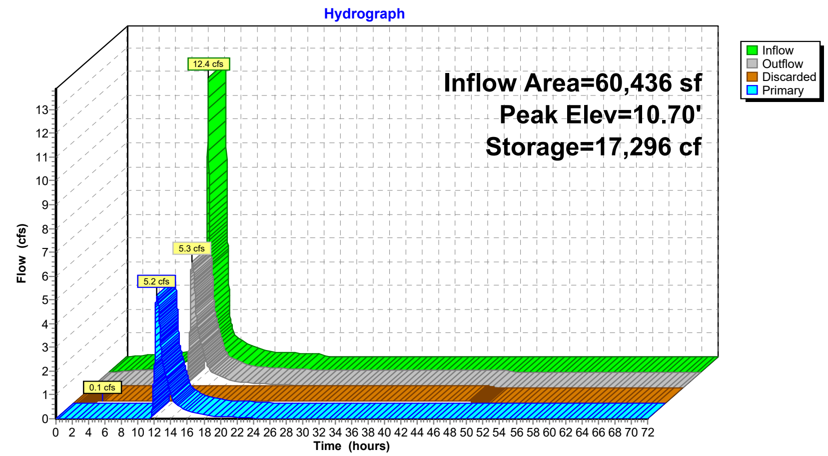
Volume	Invert	Avail.Storage	Storage Description
#1	8.00'	19,245 cf	**6.89'W x 14.06'L x 3.00'H StormTrap ST-1 Units (Irregular Shape)** x 77 22,378 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	8.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	8.00'	**15.0" Round Culvert** L= 26.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 8.00' / 7.13' S= 0.0335 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#3	Device 2	9.22'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	10.05'	**20.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 2	10.79'	**3.7' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.1 cfs @ 3.50 hrs HW=8.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=5.2 cfs @ 12.30 hrs HW=10.70' (Free Discharge)
└**2=Culvert** (Passes 5.2 cfs of 8.5 cfs potential flow)
├**3=Orifice/Grate** (Orifice Controls 3.4 cfs @ 5.51 fps)
├**4=Orifice/Grate** (Orifice Controls 1.8 cfs @ 3.32 fps)
└**5=Sharp-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 1P: Inf Syst-1



Summary for Pond 3P: Rain garden

Inflow Area = 12,275 sf, 52.50% Impervious, Inflow Depth = 8.08" for 50-Year event
Inflow = 2.5 cfs @ 12.08 hrs, Volume= 8,268 cf
Outflow = 2.5 cfs @ 12.09 hrs, Volume= 8,268 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.0 cfs @ 12.09 hrs, Volume= 506 cf
Primary = 2.5 cfs @ 12.09 hrs, Volume= 7,762 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 6.48' @ 12.09 hrs Surf.Area= 450 sf Storage= 245 cf

Plug-Flow detention time= 35.3 min calculated for 8,268 cf (100% of inflow)
Center-of-Mass det. time= 35.2 min (814.3 - 779.1)

Volume	Invert	Avail.Storage	Storage Description
#1	5.60'	253 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

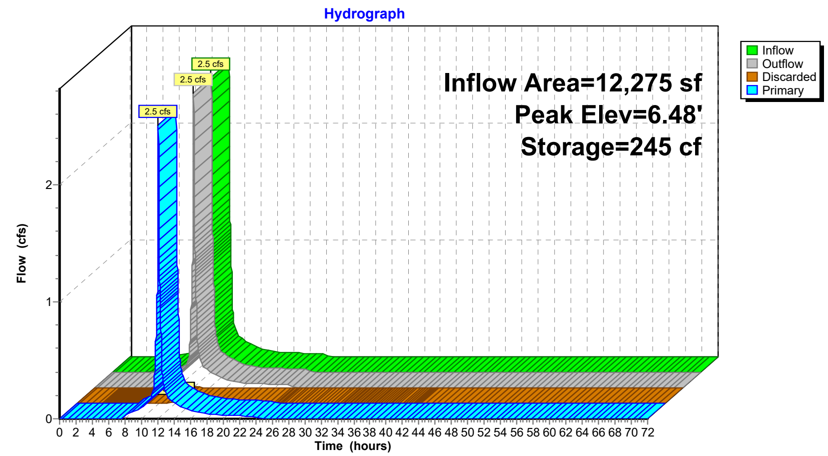
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.60	125	46.0	0	0	125
6.00	276	66.0	78	78	305
6.30	350	73.0	94	172	385
6.50	460	87.0	81	253	564

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.60'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	6.35'	**22.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.0 cfs @ 12.09 hrs HW=6.48' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=2.5 cfs @ 12.09 hrs HW=6.48' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 2.5 cfs @ 0.85 fps)

Pond 3P: Rain garden



Summary for Pond 4P: Inf Syst-2

Inflow Area = 1,112 sf, 95.68% Impervious, Inflow Depth = 9.31" for 50-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 863 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 849 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.70 hrs, Volume= 160 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 689 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.54' @ 12.09 hrs Surf.Area= 101 sf Storage= 134 cf

Plug-Flow detention time= 326.9 min calculated for 849 cf (98% of inflow)
Center-of-Mass det. time= 316.9 min (1,061.1 - 744.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

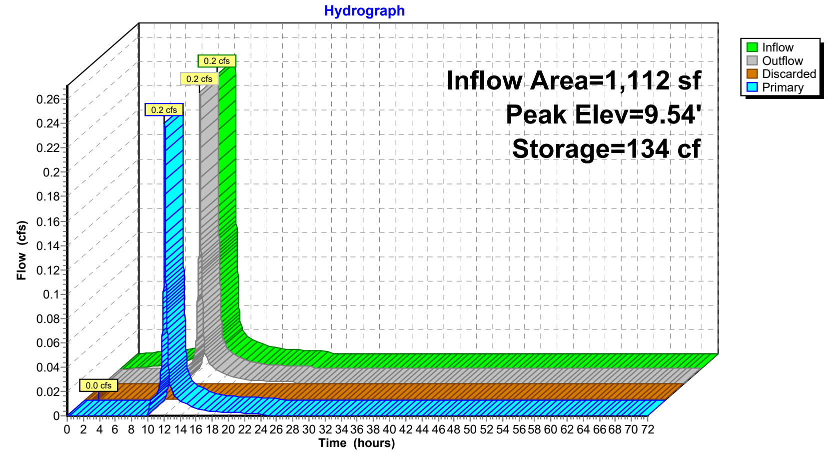
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.23'	**6.0" Round Culvert** L= 33.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.23' / 8.72' S= 0.0155 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 1.70 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.54' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.2 cfs @ 1.89 fps)

Pond 4P: Inf Syst-2



Summary for Pond 5P: Inf Syst-3

Inflow Area = 1,105 sf, 97.29% Impervious, Inflow Depth = 9.31" for 50-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 857 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 838 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.73 hrs, Volume= 160 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 678 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.68' @ 12.09 hrs Surf.Area= 101 sf Storage= 140 cf

Plug-Flow detention time= 335.8 min calculated for 838 cf (98% of inflow)
Center-of-Mass det. time= 321.7 min (1,066.0 - 744.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

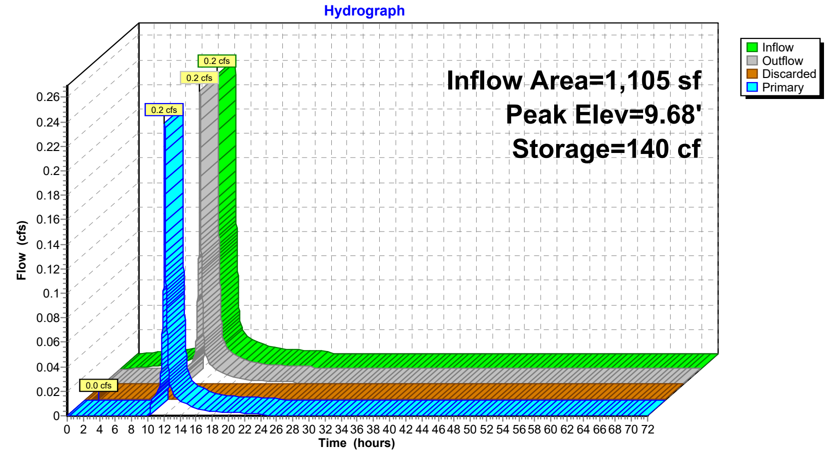
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.37'	**6.0" Round Culvert** L= 33.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.37' / 8.73' S= 0.0194 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 1.73 hrs HW=7.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.68' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.2 cfs @ 1.89 fps)

Pond 5P: Inf Syst-3



Summary for Pond 6P: Inf Syst-4

Inflow Area = 1,104 sf, 97.46% Impervious, Inflow Depth = 9.31" for 50-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 856 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 837 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.73 hrs, Volume= 160 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 677 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.68' @ 12.09 hrs Surf.Area= 101 sf Storage= 140 cf

Plug-Flow detention time= 336.1 min calculated for 837 cf (98% of inflow)
Center-of-Mass det. time= 322.0 min (1,066.2 - 744.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

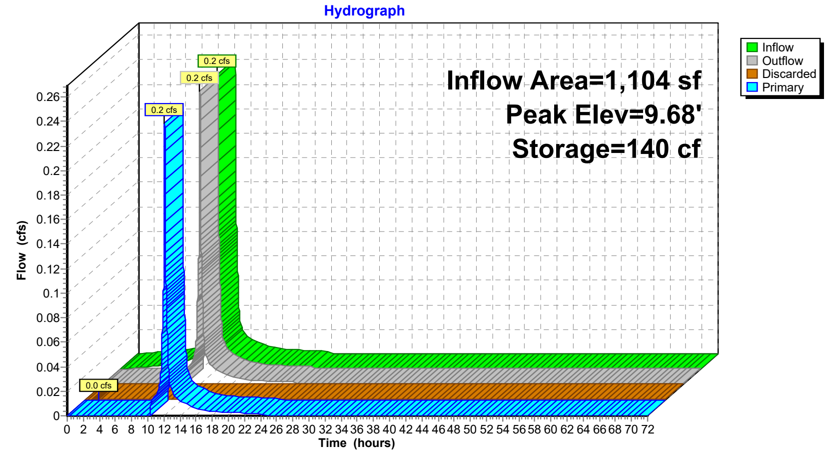
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.37'	**6.0" Round Culvert** L= 51.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.37' / 8.10' S= 0.0249 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 1.73 hrs HW=7.03' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.68' (Free Discharge)
2=Culvert (Inlet Controls 0.2 cfs @ 1.89 fps)

Pond 6P: Inf Syst-4



Summary for Pond 7P: Inf Syst-5

Inflow Area = 1,082 sf, 98.06% Impervious, Inflow Depth = 9.43" for 50-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 850 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 849 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.27 hrs, Volume= 161 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 688 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.30' @ 12.09 hrs Surf.Area= 101 sf Storage= 122 cf

Plug-Flow detention time= 318.0 min calculated for 849 cf (100% of inflow)
Center-of-Mass det. time= 317.6 min (1,056.6 - 739.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A**
			241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1
			Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf
			Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf
			10 Chambers in 2 Rows
		125 cf	Total Available Storage

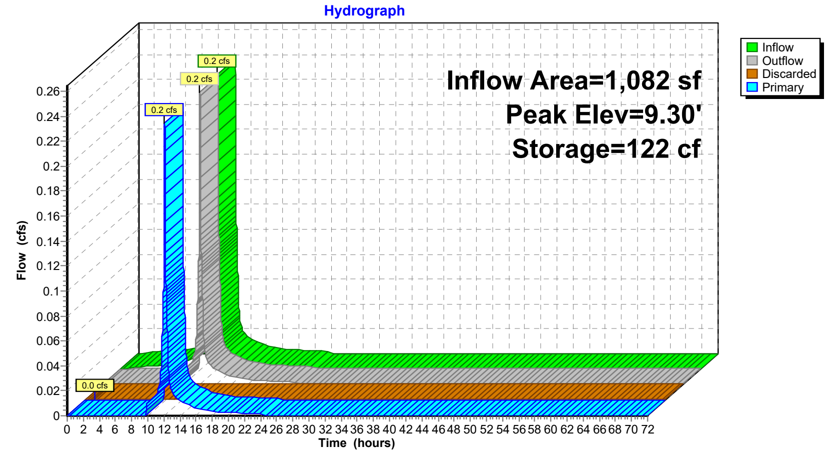
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**6.0" Round Culvert**
			L= 48.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 9.00' / 8.35' S= 0.0135 '/' Cc= 0.900
			n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 1.27 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.30' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.2 cfs @ 1.88 fps)

Pond 7P: Inf Syst-5



Summary for Pond 8P: Inf Syst-6

Inflow Area = 1,056 sf, 99.24% Impervious, Inflow Depth = 9.43" for 50-Year event
Inflow = 0.2 cfs @ 12.08 hrs, Volume= 830 cf
Outflow = 0.2 cfs @ 12.09 hrs, Volume= 829 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.30 hrs, Volume= 161 cf
Primary = 0.2 cfs @ 12.09 hrs, Volume= 668 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.32' @ 12.09 hrs Surf.Area= 101 sf Storage= 123 cf

Plug-Flow detention time= 325.6 min calculated for 829 cf (100% of inflow)
Center-of-Mass det. time= 325.0 min (1,064.0 - 739.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A** 241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1 Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf 10 Chambers in 2 Rows
		125 cf	Total Available Storage

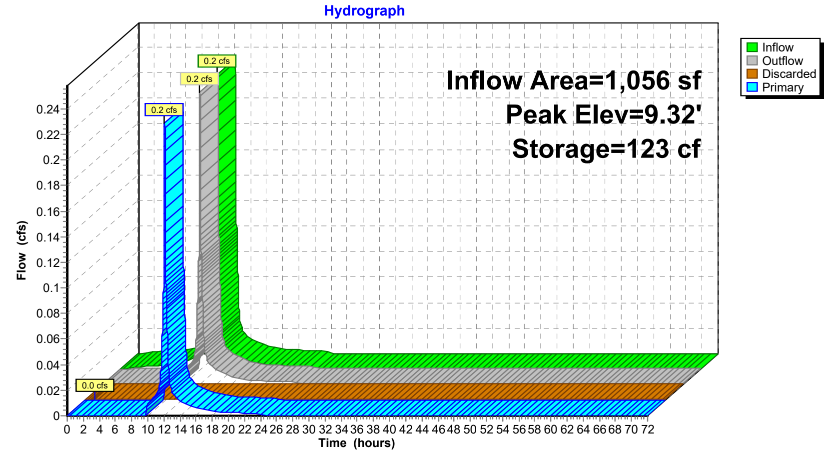
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**8.0" Round Culvert** L= 46.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.00' / 8.77' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 1.30 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.2 cfs @ 12.09 hrs HW=9.32' (Free Discharge)
└─**2=Culvert** (Barrel Controls 0.2 cfs @ 2.02 fps)

Pond 8P: Inf Syst-6



Summary for Pond 9P: Inf Syst-7

Inflow Area = 24,131 sf, 72.87% Impervious, Inflow Depth = 8.60" for 50-Year event
Inflow = 5.1 cfs @ 12.08 hrs, Volume= 17,290 cf
Outflow = 3.0 cfs @ 12.19 hrs, Volume= 17,290 cf, Atten= 41%, Lag= 6.3 min
Discarded = 0.0 cfs @ 4.01 hrs, Volume= 1,591 cf
Primary = 3.0 cfs @ 12.19 hrs, Volume= 15,699 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 8.58' @ 12.19 hrs Surf.Area= 2,422 sf Storage= 2,968 cf

Plug-Flow detention time= 48.3 min calculated for 17,290 cf (100% of inflow)
Center-of-Mass det. time= 48.2 min (815.1 - 766.9)

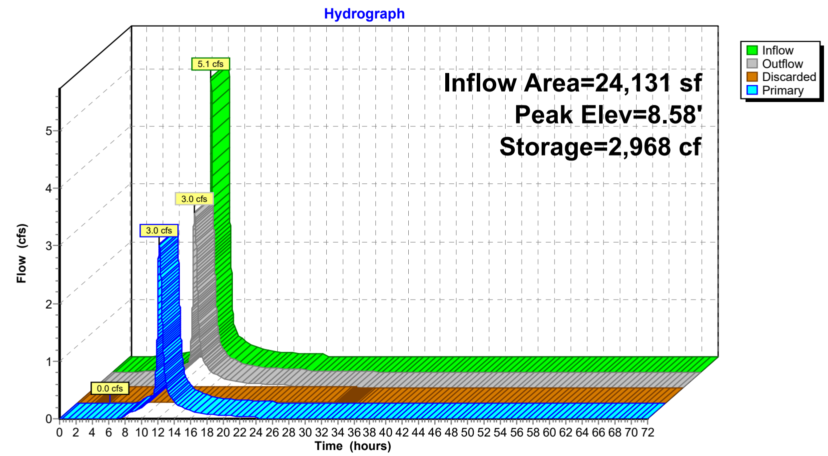
Volume	Invert	Avail.Storage	Storage Description
#1	7.15'	3,645 cf	**6.89'W x 14.06'L x 1.75'H StormTrap ST-1 Units (Irregular Shape)** x 25 4,238 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.15'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	7.15'	**12.0" Round Culvert** L= 4.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.15' / 7.13' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	7.35'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 4.01 hrs HW=7.17' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=3.0 cfs @ 12.19 hrs HW=8.58' (Free Discharge)
└─**2=Culvert** (Passes 3.0 cfs of 3.3 cfs potential flow)
  └─**3=Orifice/Grate** (Orifice Controls 3.0 cfs @ 4.95 fps)

Pond 9P: Inf Syst-7

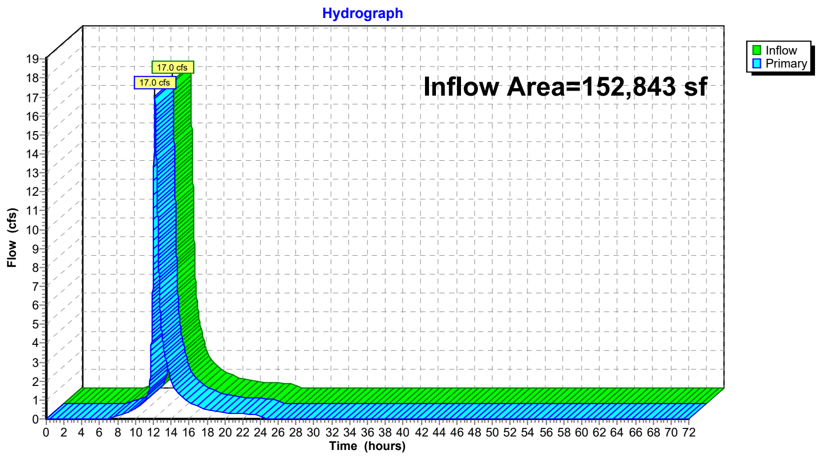


Summary for Link 1L: Towards Wetlands

Inflow Area = 152,843 sf, 50.79% Impervious, Inflow Depth = 6.54" for 50-Year event
Inflow = 17.0 cfs @ 12.18 hrs, Volume= 83,287 cf
Primary = 17.0 cfs @ 12.18 hrs, Volume= 83,287 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 1L: Towards Wetlands

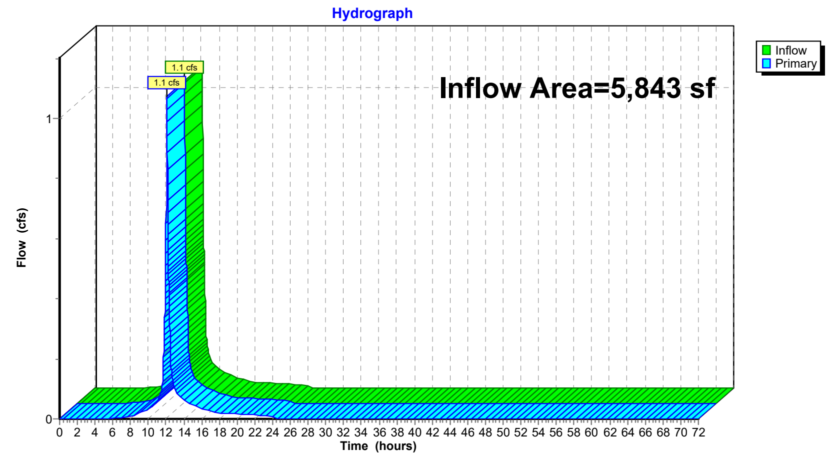


Summary for Link 2L: Towards Street

Inflow Area = 5,843 sf, 18.07% Impervious, Inflow Depth = 6.95" for 50-Year event
Inflow = 1.1 cfs @ 12.09 hrs, Volume= 3,385 cf
Primary = 1.1 cfs @ 12.09 hrs, Volume= 3,385 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 2L: Towards Street

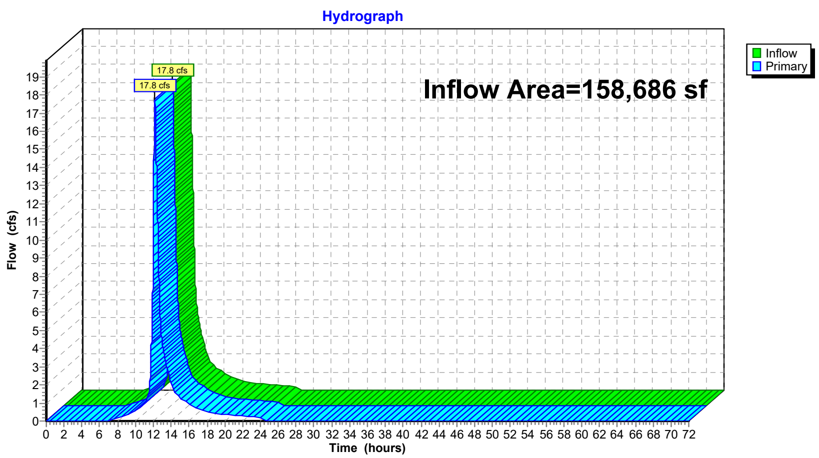


Summary for Link 100L: Total Flows

Inflow Area = 158,686 sf, 49.59% Impervious, Inflow Depth = 6.55" for 50-Year event
Inflow = 17.8 cfs @ 12.16 hrs, Volume= 86,673 cf
Primary = 17.8 cfs @ 12.16 hrs, Volume= 86,673 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 100L: Total Flows



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: CB-1 Runoff Area=22,742 sf 72.16% Impervious Runoff Depth=10.39"
Tc=6.0 min CN=91 Runoff=5.8 cfs 19,696 cf

Subcatchment2S: Building Roof Runoff Area=32,925 sf 100.00% Impervious Runoff Depth=11.26"
Tc=6.0 min CN=98 Runoff=8.5 cfs 30,891 cf

Subcatchment3.1S: Backyard ADs Runoff Area=8,985 sf 3.03% Impervious Runoff Depth=8.28"
Flow Length=147' Tc=10.3 min CN=75 Runoff=1.7 cfs 6,203 cf

Subcatchment3S: Townhouse Roofs Runoff Area=13,067 sf 100.00% Impervious Runoff Depth=11.26"
Tc=6.0 min CN=98 Runoff=3.4 cfs 12,260 cf

Subcatchment4.2S: TD-2 Runoff Area=1,112 sf 95.68% Impervious Runoff Depth=11.14"
Tc=6.0 min CN=97 Runoff=0.3 cfs 1,032 cf

Subcatchment4.3S: TD-3 Runoff Area=1,105 sf 97.29% Impervious Runoff Depth=11.14"
Tc=6.0 min CN=97 Runoff=0.3 cfs 1,026 cf

Subcatchment4.4S: TD-4 Runoff Area=1,104 sf 97.46% Impervious Runoff Depth=11.14"
Tc=6.0 min CN=97 Runoff=0.3 cfs 1,025 cf

Subcatchment4.5S: TD-5 Runoff Area=1,082 sf 98.06% Impervious Runoff Depth=11.26"
Tc=6.0 min CN=98 Runoff=0.3 cfs 1,015 cf

Subcatchment4.6S: TD-6 Runoff Area=1,056 sf 99.24% Impervious Runoff Depth=11.26"
Tc=6.0 min CN=98 Runoff=0.3 cfs 991 cf

Subcatchment5.1S: TD-1A Runoff Area=1,389 sf 84.59% Impervious Runoff Depth=10.77"
Tc=6.0 min CN=94 Runoff=0.4 cfs 1,246 cf

Subcatchment5S: TD-1B Runoff Area=4,462 sf 42.78% Impervious Runoff Depth=9.49"
Tc=6.0 min CN=84 Runoff=1.1 cfs 3,530 cf

Subcatchment6.1S: East driveway Runoff Area=12,275 sf 52.50% Impervious Runoff Depth=9.88"
Tc=6.0 min CN=87 Runoff=3.0 cfs 10,109 cf

Subcatchment6S: Bypass Towards Runoff Area=51,539 sf 0.21% Impervious Runoff Depth=8.15"
Flow Length=125' Tc=14.0 min CN=74 Runoff=8.7 cfs 34,988 cf

Subcatchment7S: To Street Runoff Area=5,843 sf 18.07% Impervious Runoff Depth=8.69"
Tc=6.0 min CN=78 Runoff=1.3 cfs 4,233 cf

Pond 1P: Inf Syst-1 Peak Elev=11.00' Storage=19,245 cf Inflow=14.8 cfs 53,582 cf
Discarded=0.1 cfs 15,354 cf Primary=7.3 cfs 38,228 cf Outflow=7.4 cfs 53,582 cf

Pond 3P: Rain garden Peak Elev=6.50' Storage=253 cf Inflow=3.0 cfs 10,109 cf
Discarded=0.0 cfs 518 cf Primary=3.0 cfs 9,592 cf Outflow=3.0 cfs 10,109 cf

Pond 4P: Inf Syst-2 Peak Elev=9.57' Storage=136 cf Inflow=0.3 cfs 1,032 cf
Discarded=0.0 cfs 161 cf Primary=0.3 cfs 858 cf Outflow=0.3 cfs 1,018 cf

Pond 5P: Inf Syst-3 Peak Elev=9.71' Storage=141 cf Inflow=0.3 cfs 1,026 cf
Discarded=0.0 cfs 161 cf Primary=0.3 cfs 846 cf Outflow=0.3 cfs 1,006 cf

Pond 6P: Inf Syst-4 Peak Elev=9.71' Storage=141 cf Inflow=0.3 cfs 1,025 cf
Discarded=0.0 cfs 161 cf Primary=0.3 cfs 845 cf Outflow=0.3 cfs 1,005 cf

Pond 7P: Inf Syst-5 Peak Elev=9.34' Storage=123 cf Inflow=0.3 cfs 1,015 cf
Discarded=0.0 cfs 161 cf Primary=0.3 cfs 853 cf Outflow=0.3 cfs 1,014 cf

Pond 8P: Inf Syst-6 Peak Elev=9.35' Storage=124 cf Inflow=0.3 cfs 991 cf
Discarded=0.0 cfs 161 cf Primary=0.3 cfs 828 cf Outflow=0.3 cfs 990 cf

Pond 9P: Inf Syst-7 Peak Elev=8.86' Storage=3,555 cf Inflow=6.1 cfs 20,942 cf
Discarded=0.0 cfs 1,621 cf Primary=3.4 cfs 19,322 cf Outflow=3.4 cfs 20,942 cf

Link 1L: Towards Wetlands Inflow=21.4 cfs 105,660 cf
Primary=21.4 cfs 105,660 cf

Link 2L: Towards Street Inflow=1.3 cfs 4,233 cf
Primary=1.3 cfs 4,233 cf

Link 100L: Total Flows Inflow=22.3 cfs 109,893 cf
Primary=22.3 cfs 109,893 cf

Total Runoff Area = 158,686 sf Runoff Volume = 128,244 cf Average Runoff Depth = 9.70"
50.41% Pervious = 79,997 sf 49.59% Impervious = 78,689 sf

Summary for Subcatchment 1S: CB-1

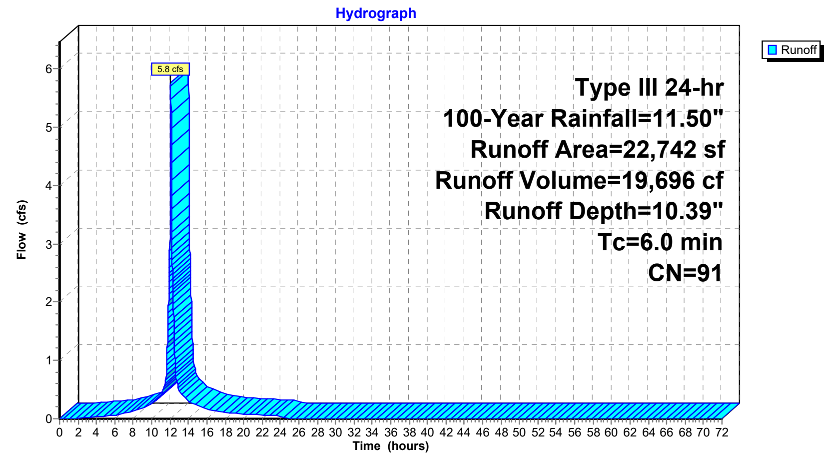
Runoff = 5.8 cfs @ 12.08 hrs, Volume= 19,696 cf, Depth=10.39"
Routed to Pond 9P : Inf Syst-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
16,410	98	Paved parking, HSG C
6,332	74	>75% Grass cover, Good, HSG C
22,742	91	Weighted Average
6,332		27.84% Pervious Area
16,410		72.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 1S: CB-1



Summary for Subcatchment 2S: Building Roof

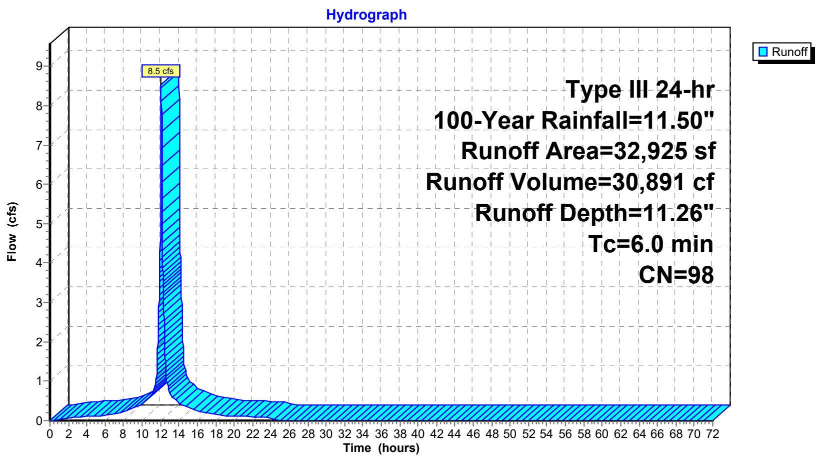
Runoff = 8.5 cfs @ 12.08 hrs, Volume= 30,891 cf, Depth=11.26"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
32,925	98	Roofs, HSG C
32,925		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 2S: Building Roof



Summary for Subcatchment 3.1S: Backyard ADs

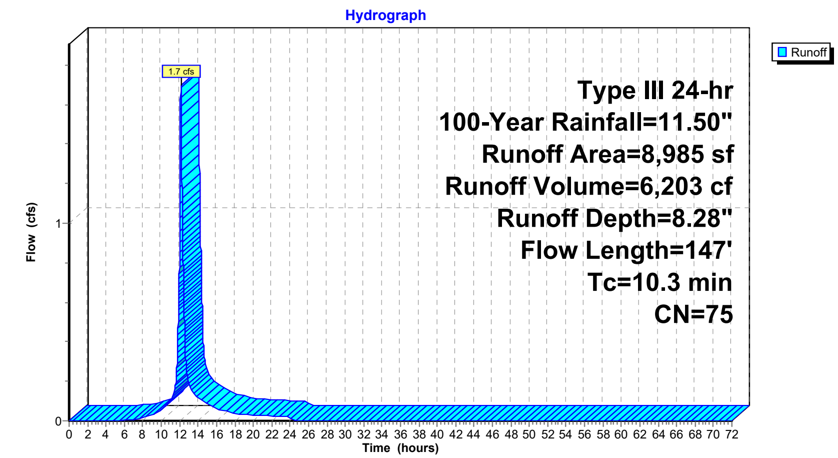
Runoff = 1.7 cfs @ 12.14 hrs, Volume= 6,203 cf, Depth= 8.28"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

	Area (sf)	CN	Description
	272	98	Unconnected pavement, HSG C
	8,302	74	>75% Grass cover, Good, HSG C
*	411	89	Gravel sidewalk, HSG C
	8,985	75	Weighted Average
	8,713		96.97% Pervious Area
	272		3.03% Impervious Area
	272		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	50	0.0142	0.09		**Sheet Flow,** Grass: Dense n= 0.240 P2= 3.23"
0.9	97	0.0154	1.86		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
10.3	147	Total			

Subcatchment 3.1S: Backyard ADs



Summary for Subcatchment 3S: Townhouse Roofs

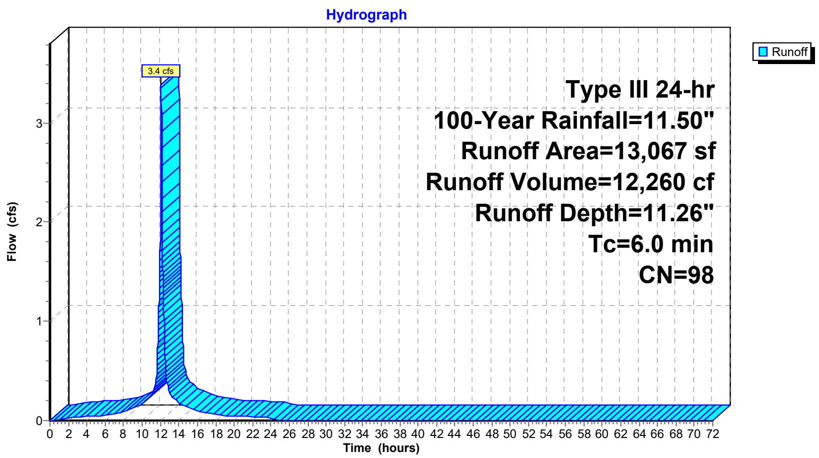
Runoff = 3.4 cfs @ 12.08 hrs, Volume= 12,260 cf, Depth=11.26"
Routed to Pond 1P : Inf Syst-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
13,067	98	Roofs, HSG C
13,067		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 3S: Townhouse Roofs



Summary for Subcatchment 4.2S: TD-2

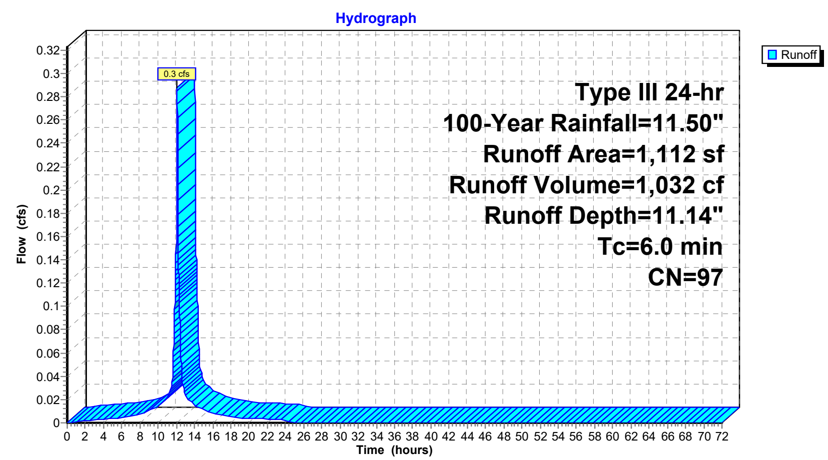
Runoff = 0.3 cfs @ 12.08 hrs, Volume= 1,032 cf, Depth=11.14"
Routed to Pond 4P : Inf Syst-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
1,064	98	Paved parking, HSG C
48	74	>75% Grass cover, Good, HSG C
1,112	97	Weighted Average
48		4.32% Pervious Area
1,064		95.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.2S: TD-2



Summary for Subcatchment 4.3S: TD-3

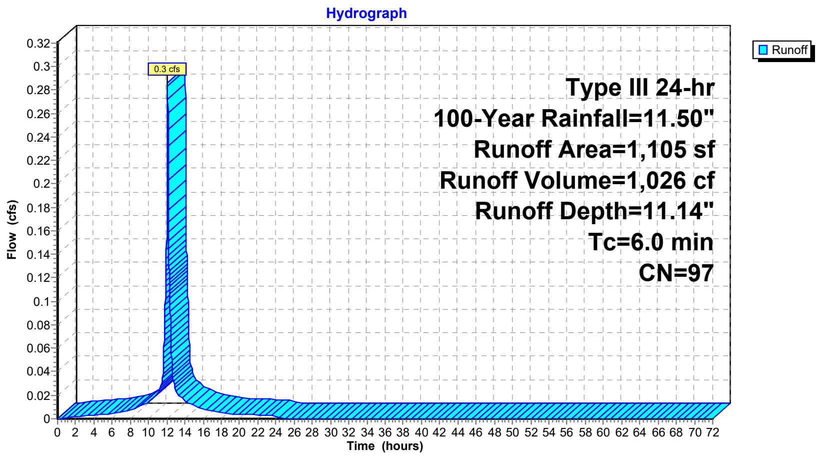
Runoff = 0.3 cfs @ 12.08 hrs, Volume= 1,026 cf, Depth=11.14"
Routed to Pond 5P : Inf Syst-3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
1,075	98	Paved parking, HSG C
30	74	>75% Grass cover, Good, HSG C
1,105	97	Weighted Average
30		2.71% Pervious Area
1,075		97.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.3S: TD-3



Summary for Subcatchment 4.4S: TD-4

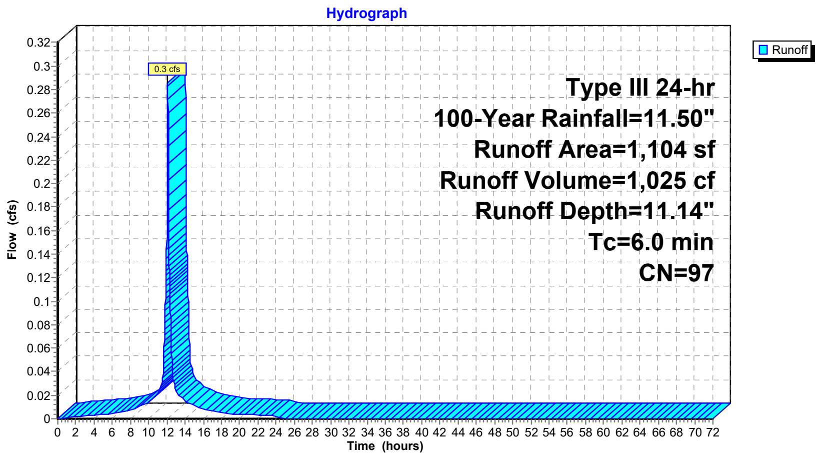
Runoff = 0.3 cfs @ 12.08 hrs, Volume= 1,025 cf, Depth=11.14"
Routed to Pond 6P : Inf Syst-4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
1,076	98	Paved parking, HSG C
28	74	>75% Grass cover, Good, HSG C
1,104	97	Weighted Average
28		2.54% Pervious Area
1,076		97.46% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.4S: TD-4



Summary for Subcatchment 4.5S: TD-5

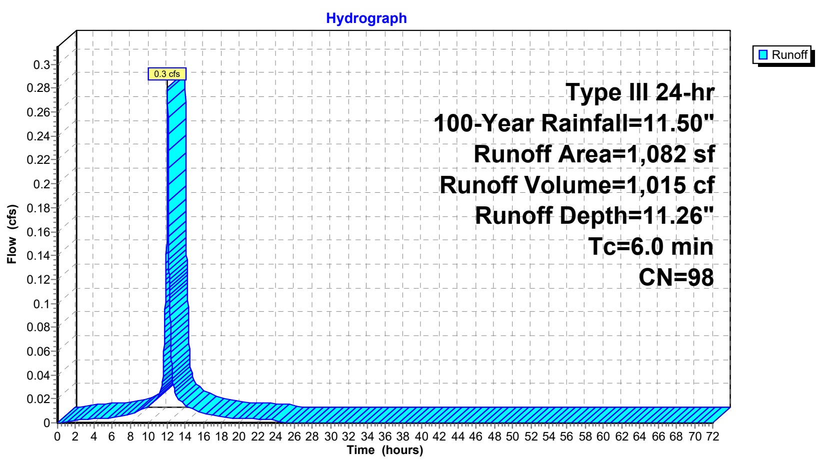
Runoff = 0.3 cfs @ 12.08 hrs, Volume= 1,015 cf, Depth=11.26"
Routed to Pond 7P : Inf Syst-5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
1,061	98	Paved parking, HSG C
21	74	>75% Grass cover, Good, HSG C
1,082	98	Weighted Average
21		1.94% Pervious Area
1,061		98.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.5S: TD-5



Summary for Subcatchment 4.6S: TD-6

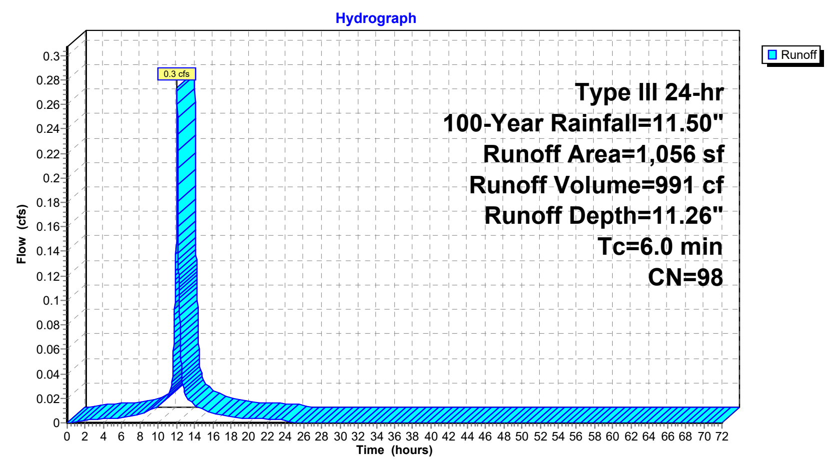
Runoff = 0.3 cfs @ 12.08 hrs, Volume= 991 cf, Depth=11.26"
Routed to Pond 8P : Inf Syst-6

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
1,048	98	Paved parking, HSG C
8	74	>75% Grass cover, Good, HSG C
1,056	98	Weighted Average
8		0.76% Pervious Area
1,048		99.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 4.6S: TD-6



Summary for Subcatchment 5.1S: TD-1A

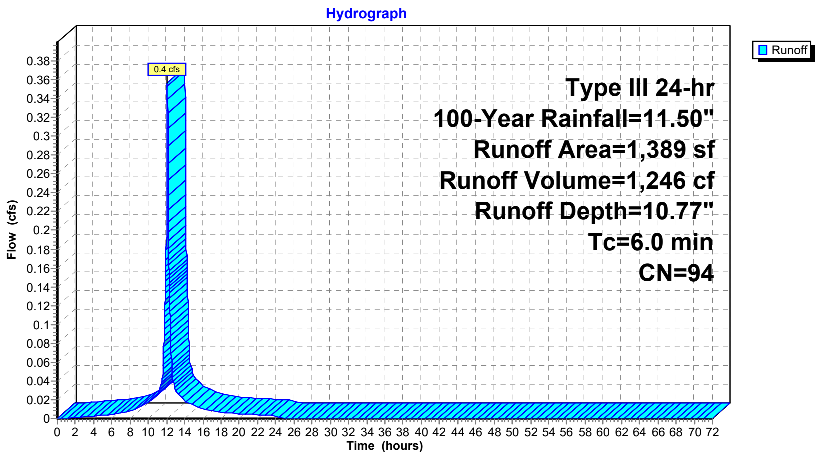
Runoff = 0.4 cfs @ 12.08 hrs, Volume= 1,246 cf, Depth=10.77"
Routed to Pond 9P : Inf Syst-7

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
1,175	98	Paved parking, HSG C
214	74	>75% Grass cover, Good, HSG C
1,389	94	Weighted Average
214		15.41% Pervious Area
1,175		84.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 5.1S: TD-1A



Summary for Subcatchment 5S: TD-1B

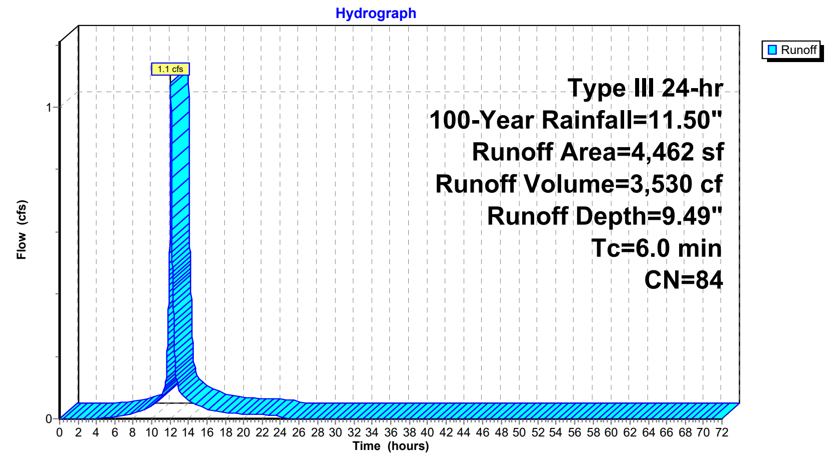
Runoff = 1.1 cfs @ 12.08 hrs, Volume= 3,530 cf, Depth= 9.49"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
1,909	98	Paved parking, HSG C
2,553	74	>75% Grass cover, Good, HSG C
4,462	84	Weighted Average
2,553		57.22% Pervious Area
1,909		42.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 5S: TD-1B



Summary for Subcatchment 6.1S: East driveway

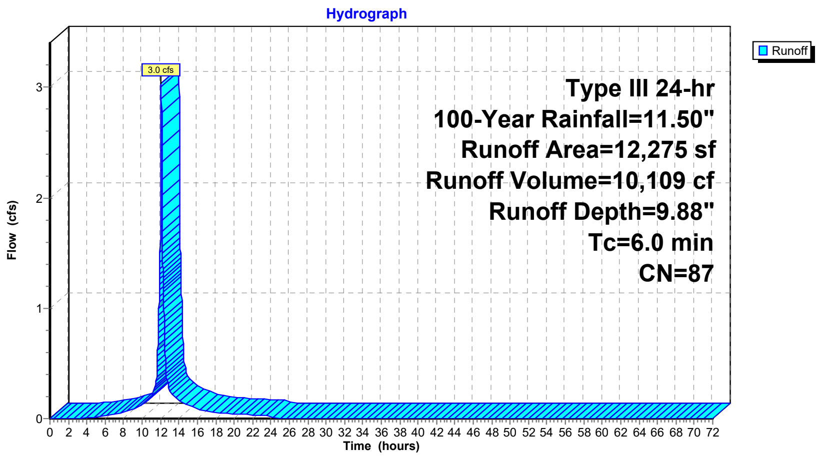
Runoff = 3.0 cfs @ 12.08 hrs, Volume= 10,109 cf, Depth= 9.88"
Routed to Pond 3P : Rain garden

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
5,611	74	>75% Grass cover, Good, HSG C
6,444	98	Paved roads w/curbs & sewers, HSG C
220	89	Gravel roads, HSG C
12,275	87	Weighted Average
5,831		47.50% Pervious Area
6,444		52.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 6.1S: East driveway



Summary for Subcatchment 6S: Bypass Towards Wetlands

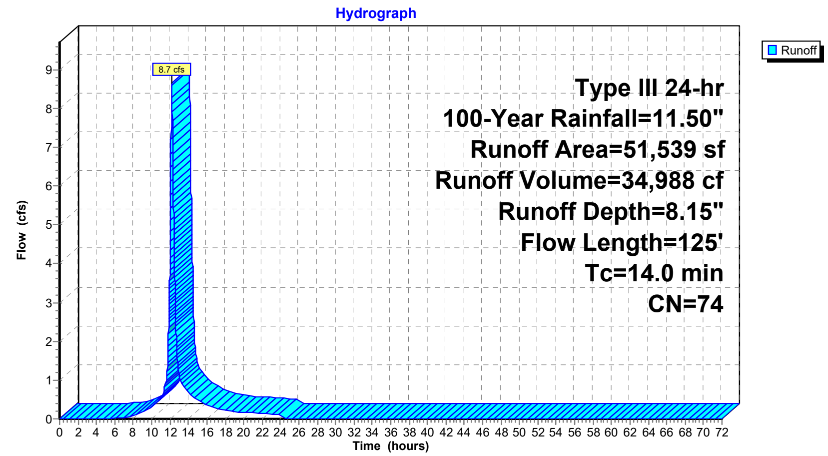
Runoff = 8.7 cfs @ 12.18 hrs, Volume= 34,988 cf, Depth= 8.15"
Routed to Link 1L : Towards Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
4,985	70	Woods, Good, HSG C
46,447	74	>75% Grass cover, Good, HSG C
107	98	Roofs, HSG C
51,539	74	Weighted Average
51,432		99.79% Pervious Area
107		0.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	50	0.0220	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.23"
2.2	75	0.0133	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	125	Total			

Subcatchment 6S: Bypass Towards Wetlands



Summary for Subcatchment 7S: To Street

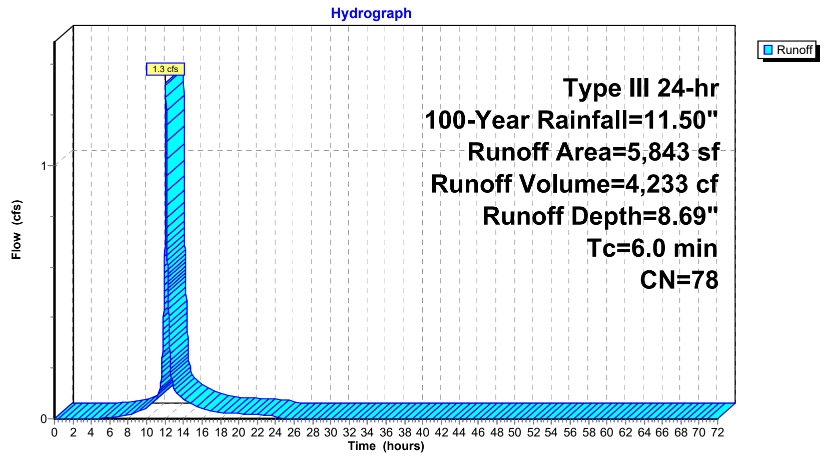
Runoff = 1.3 cfs @ 12.09 hrs, Volume= 4,233 cf, Depth= 8.69"
Routed to Link 2L : Towards Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=11.50"

Area (sf)	CN	Description
1,056	98	Paved parking, HSG C
4,787	74	>75% Grass cover, Good, HSG C
5,843	78	Weighted Average
4,787		81.93% Pervious Area
1,056		18.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Min. Tc**

Subcatchment 7S: To Street



Summary for Pond 1P: Inf Syst-1

Inflow Area = 60,436 sf, 85.36% Impervious, Inflow Depth = 10.64" for 100-Year event
Inflow = 14.8 cfs @ 12.09 hrs, Volume= 53,582 cf
Outflow = 7.4 cfs @ 12.25 hrs, Volume= 53,582 cf, Atten= 50%, Lag= 9.7 min
Discarded = 0.1 cfs @ 2.72 hrs, Volume= 15,354 cf
Primary = 7.3 cfs @ 12.25 hrs, Volume= 38,228 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 11.00' @ 12.25 hrs Surf.Area= 7,459 sf Storage= 19,245 cf

Plug-Flow detention time= 272.3 min calculated for 53,582 cf (100% of inflow)
Center-of-Mass det. time= 272.2 min (1,021.3 - 749.0)

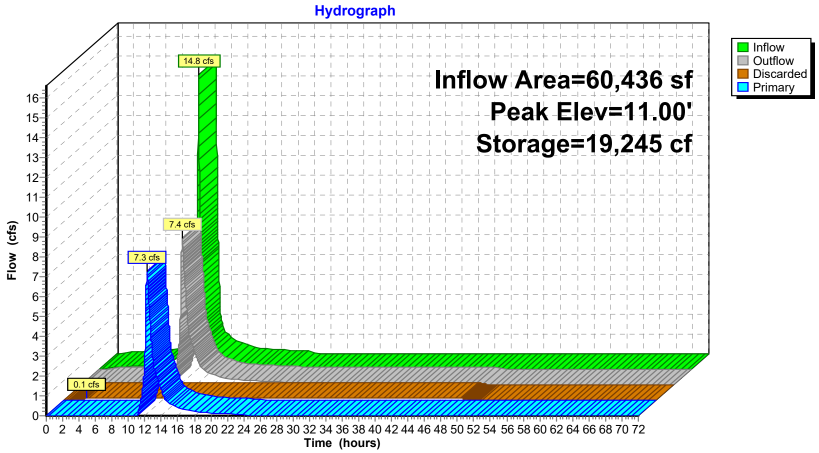
Volume	Invert	Avail.Storage	Storage Description
#1	8.00'	19,245 cf	**6.89'W x 14.06'L x 3.00'H StormTrap ST-1 Units (Irregular Shape)** x 77 22,378 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	8.00'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	8.00'	**15.0" Round Culvert** L= 26.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 8.00' / 7.13' S= 0.0335 '/' Cc= 0.900 n= 0.013, Flow Area= 1.23 sf
#3	Device 2	9.22'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 2	10.05'	**20.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 2	10.79'	**3.7' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.1 cfs @ 2.72 hrs HW=8.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=7.3 cfs @ 12.25 hrs HW=11.00' (Free Discharge)
└─**2=Culvert** (Passes 7.3 cfs of 9.1 cfs potential flow)
  ├─**3=Orifice/Grate** (Orifice Controls 3.7 cfs @ 6.12 fps)
  ├─**4=Orifice/Grate** (Orifice Controls 2.4 cfs @ 4.26 fps)
  └─**5=Sharp-Crested Rectangular Weir** (Weir Controls 1.2 cfs @ 1.51 fps)

Pond 1P: Inf Syst-1



Summary for Pond 3P: Rain garden

Inflow Area = 12,275 sf, 52.50% Impervious, Inflow Depth = 9.88" for 100-Year event
Inflow = 3.0 cfs @ 12.08 hrs, Volume= 10,109 cf
Outflow = 3.0 cfs @ 12.08 hrs, Volume= 10,109 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.0 cfs @ 12.08 hrs, Volume= 518 cf
Primary = 3.0 cfs @ 12.08 hrs, Volume= 9,592 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 6.50' @ 12.08 hrs Surf.Area= 460 sf Storage= 253 cf

Plug-Flow detention time= 29.6 min calculated for 10,108 cf (100% of inflow)
Center-of-Mass det. time= 29.8 min (803.8 - 774.0)

Volume	Invert	Avail.Storage	Storage Description
#1	5.60'	253 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

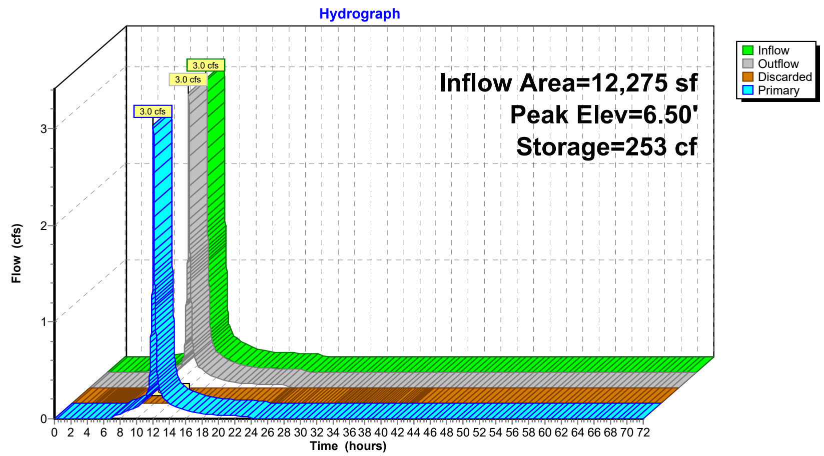
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
5.60	125	46.0	0	0	125
6.00	276	66.0	78	78	305
6.30	350	73.0	94	172	385
6.50	460	87.0	81	253	564

Device	Routing	Invert	Outlet Devices
#1	Discarded	5.60'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	6.35'	**22.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.0 cfs @ 12.08 hrs HW=6.50' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=3.0 cfs @ 12.08 hrs HW=6.50' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 3.0 cfs @ 0.91 fps)

Pond 3P: Rain garden



Summary for Pond 4P: Inf Syst-2

Inflow Area = 1,112 sf, 95.68% Impervious, Inflow Depth = 11.14" for 100-Year event
Inflow = 0.3 cfs @ 12.08 hrs, Volume= 1,032 cf
Outflow = 0.3 cfs @ 12.09 hrs, Volume= 1,018 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.40 hrs, Volume= 161 cf
Primary = 0.3 cfs @ 12.09 hrs, Volume= 858 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.57' @ 12.09 hrs Surf.Area= 101 sf Storage= 136 cf

Plug-Flow detention time= 278.5 min calculated for 1,018 cf (99% of inflow)
Center-of-Mass det. time= 269.7 min (1,011.6 - 741.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

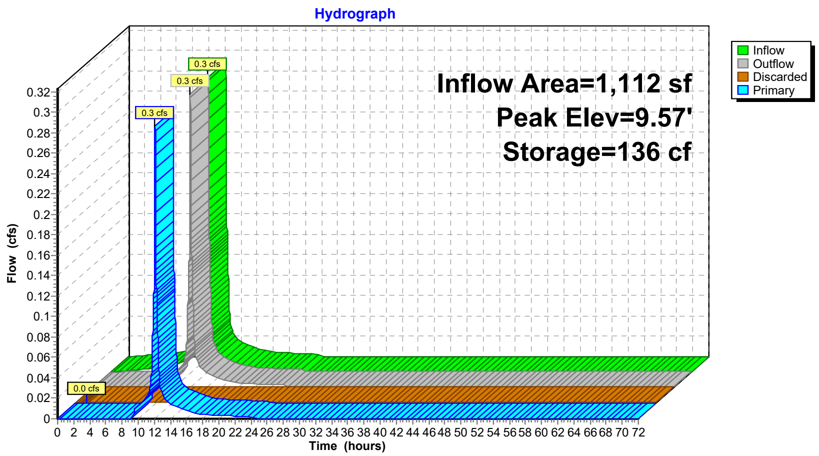
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.23'	**6.0" Round Culvert** L= 33.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.23' / 8.72' S= 0.0155 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 1.40 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.3 cfs @ 12.09 hrs HW=9.57' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.3 cfs @ 1.99 fps)

Pond 4P: Inf Syst-2



Summary for Pond 5P: Inf Syst-3

Inflow Area = 1,105 sf, 97.29% Impervious, Inflow Depth = 11.14" for 100-Year event
Inflow = 0.3 cfs @ 12.08 hrs, Volume= 1,026 cf
Outflow = 0.3 cfs @ 12.09 hrs, Volume= 1,006 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.42 hrs, Volume= 161 cf
Primary = 0.3 cfs @ 12.09 hrs, Volume= 846 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.71' @ 12.09 hrs Surf.Area= 101 sf Storage= 141 cf

Plug-Flow detention time= 286.0 min calculated for 1,006 cf (98% of inflow)
Center-of-Mass det. time= 273.7 min (1,015.6 - 741.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

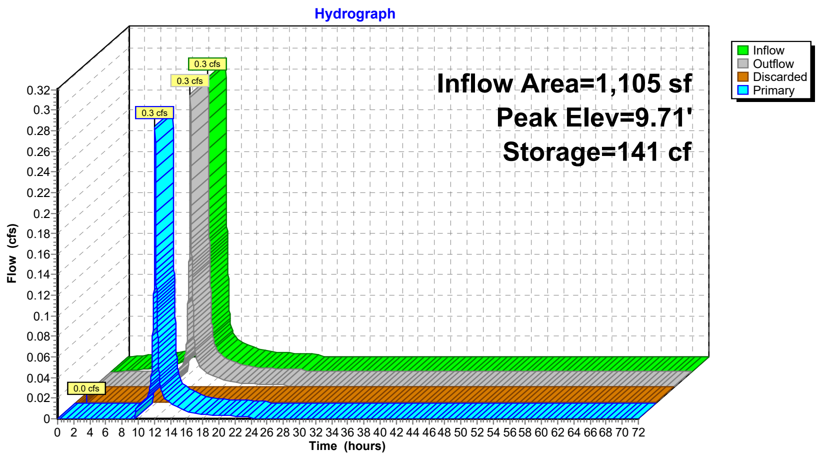
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.37'	**6.0" Round Culvert** L= 33.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.37' / 8.73' S= 0.0194 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 1.42 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.3 cfs @ 12.09 hrs HW=9.71' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.3 cfs @ 1.99 fps)

Pond 5P: Inf Syst-3



Summary for Pond 6P: Inf Syst-4

Inflow Area = 1,104 sf, 97.46% Impervious, Inflow Depth = 11.14" for 100-Year event
Inflow = 0.3 cfs @ 12.08 hrs, Volume= 1,025 cf
Outflow = 0.3 cfs @ 12.09 hrs, Volume= 1,005 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.42 hrs, Volume= 161 cf
Primary = 0.3 cfs @ 12.09 hrs, Volume= 845 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.71' @ 12.09 hrs Surf.Area= 101 sf Storage= 141 cf

Plug-Flow detention time= 285.9 min calculated for 1,005 cf (98% of inflow)
Center-of-Mass det. time= 274.0 min (1,015.8 - 741.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	84 cf	**7.28'W x 13.84'L x 2.72'H Field A** 274 cf Overall - 64 cf Embedded = 210 cf x 40.0% Voids
#2A	7.25'	57 cf	**Ferguson R-Tank XD 12** x 10 Inside #1 Inside= 19.7"W x 23.6"H => 2.91 sf x 1.97'L = 5.7 cf Outside= 19.7"W x 23.6"H => 3.23 sf x 1.97'L = 6.4 cf 10 Chambers in 2 Rows
		141 cf	Total Available Storage

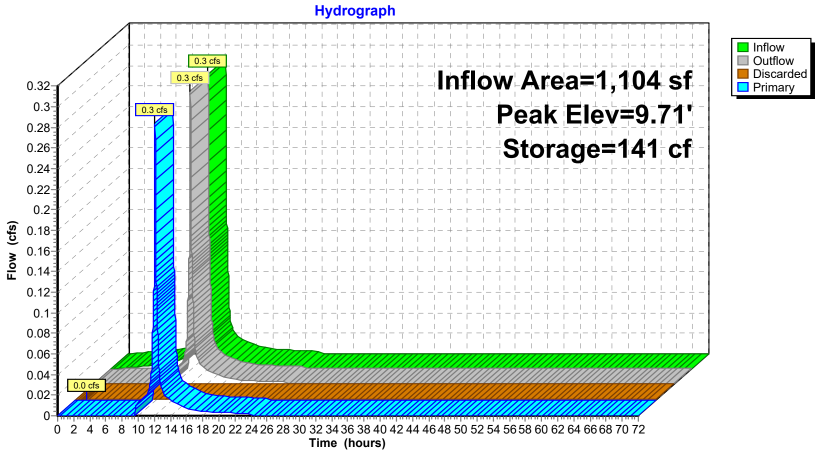
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.37'	**6.0" Round Culvert** L= 51.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.37' / 8.10' S= 0.0249 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 1.42 hrs HW=7.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.3 cfs @ 12.09 hrs HW=9.71' (Free Discharge)
└**2=Culvert** (Inlet Controls 0.3 cfs @ 1.99 fps)

Pond 6P: Inf Syst-4



Summary for Pond 7P: Inf Syst-5

Inflow Area = 1,082 sf, 98.06% Impervious, Inflow Depth = 11.26" for 100-Year event
Inflow = 0.3 cfs @ 12.08 hrs, Volume= 1,015 cf
Outflow = 0.3 cfs @ 12.09 hrs, Volume= 1,014 cf, Atten= 1%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.05 hrs, Volume= 161 cf
Primary = 0.3 cfs @ 12.09 hrs, Volume= 853 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.34' @ 12.09 hrs Surf.Area= 101 sf Storage= 123 cf

Plug-Flow detention time= 271.3 min calculated for 1,014 cf (100% of inflow)
Center-of-Mass det. time= 271.0 min (1,008.3 - 737.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A** 241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1 Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf 10 Chambers in 2 Rows
		125 cf	Total Available Storage

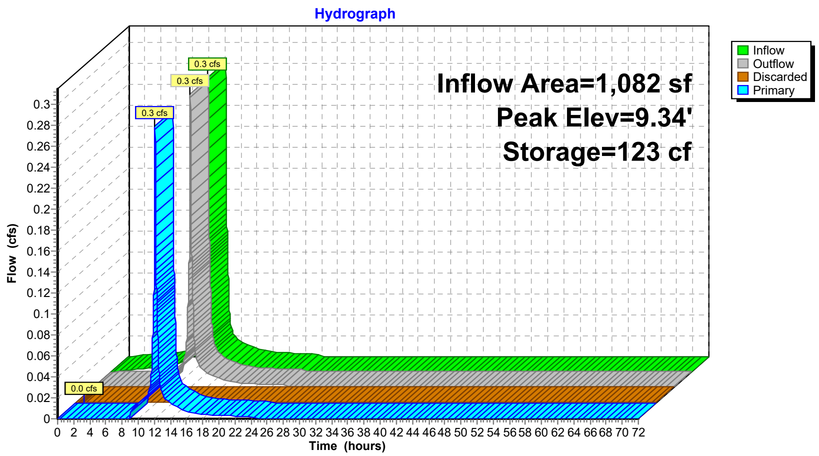
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**6.0" Round Culvert** L= 48.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.00' / 8.35' S= 0.0135 '/' Cc= 0.900 n= 0.013, Flow Area= 0.20 sf

Discarded OutFlow Max=0.0 cfs @ 1.05 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.3 cfs @ 12.09 hrs HW=9.34' (Free Discharge)
└─**2=Culvert** (Inlet Controls 0.3 cfs @ 1.98 fps)

Pond 7P: Inf Syst-5



Summary for Pond 8P: Inf Syst-6

Inflow Area = 1,056 sf, 99.24% Impervious, Inflow Depth = 11.26" for 100-Year event
Inflow = 0.3 cfs @ 12.08 hrs, Volume= 991 cf
Outflow = 0.3 cfs @ 12.09 hrs, Volume= 990 cf, Atten= 0%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.08 hrs, Volume= 161 cf
Primary = 0.3 cfs @ 12.09 hrs, Volume= 828 cf
Routed to Pond 1P : Inf Syst-1

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.35' @ 12.09 hrs Surf.Area= 101 sf Storage= 124 cf

Plug-Flow detention time= 277.9 min calculated for 990 cf (100% of inflow)
Center-of-Mass det. time= 277.4 min (1,014.7 - 737.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A** 241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1 Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf 10 Chambers in 2 Rows
		125 cf	Total Available Storage

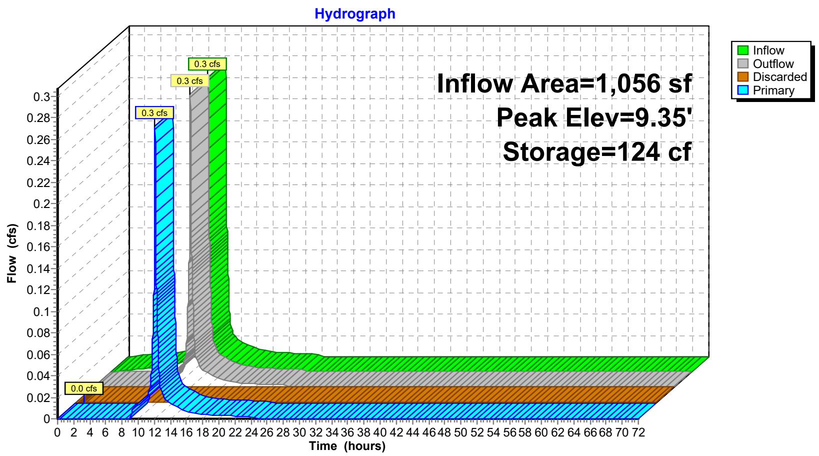
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**8.0" Round Culvert** L= 46.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.00' / 8.77' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 1.08 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.3 cfs @ 12.09 hrs HW=9.35' (Free Discharge)
└─**2=Culvert** (Barrel Controls 0.3 cfs @ 2.11 fps)

Pond 8P: Inf Syst-6



Summary for Pond 9P: Inf Syst-7

Inflow Area = 24,131 sf, 72.87% Impervious, Inflow Depth = 10.41" for 100-Year event
Inflow = 6.1 cfs @ 12.08 hrs, Volume= 20,942 cf
Outflow = 3.4 cfs @ 12.20 hrs, Volume= 20,942 cf, Atten= 44%, Lag= 7.0 min
Discarded = 0.0 cfs @ 3.41 hrs, Volume= 1,621 cf
Primary = 3.4 cfs @ 12.20 hrs, Volume= 19,322 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 8.86' @ 12.20 hrs Surf.Area= 2,422 sf Storage= 3,555 cf

Plug-Flow detention time= 43.5 min calculated for 20,940 cf (100% of inflow)
Center-of-Mass det. time= 43.6 min (806.2 - 762.6)

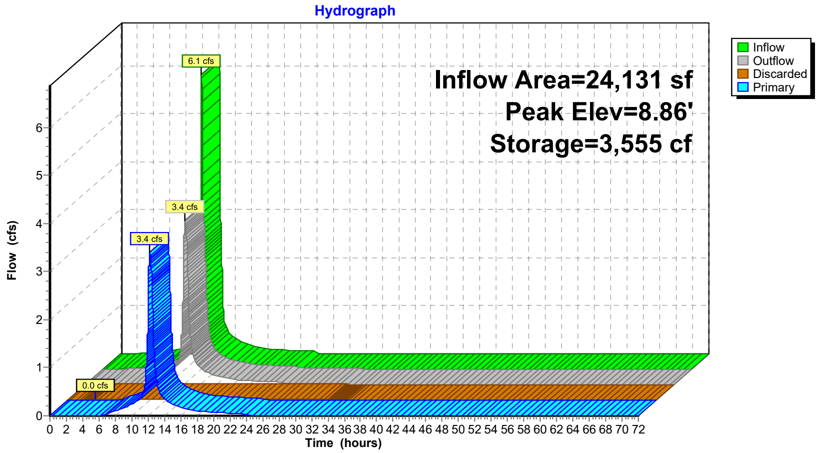
Volume	Invert	Avail.Storage	Storage Description
#1	7.15'	3,645 cf	**6.89'W x 14.06'L x 1.75'H StormTrap ST-1 Units (Irregular Shape)** x 25 4,238 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.15'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	7.15'	**12.0" Round Culvert** L= 4.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.15' / 7.13' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	7.35'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 3.41 hrs HW=7.17' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=3.4 cfs @ 12.20 hrs HW=8.86' (Free Discharge)
└─**2=Culvert** (Passes 3.4 cfs of 4.2 cfs potential flow)
 └─**3=Orifice/Grate** (Orifice Controls 3.4 cfs @ 5.57 fps)

Pond 9P: Inf Syst-7

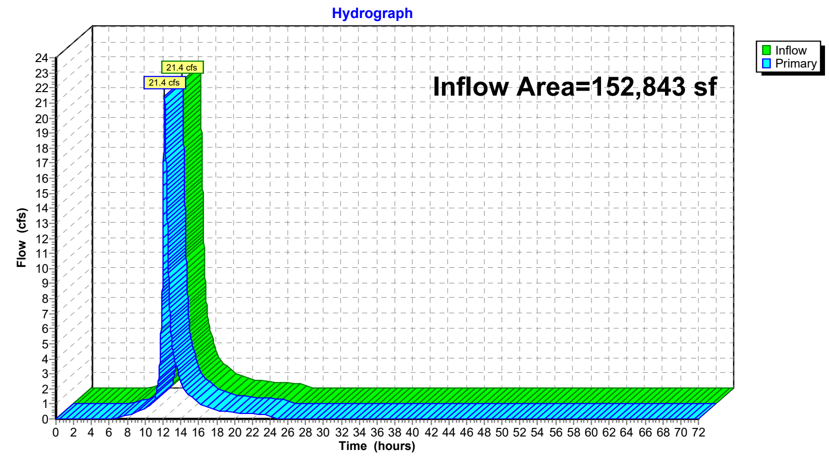


Summary for Link 1L: Towards Wetlands

Inflow Area = 152,843 sf, 50.79% Impervious, Inflow Depth = 8.30" for 100-Year event
Inflow = 21.4 cfs @ 12.19 hrs, Volume= 105,660 cf
Primary = 21.4 cfs @ 12.19 hrs, Volume= 105,660 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 1L: Towards Wetlands

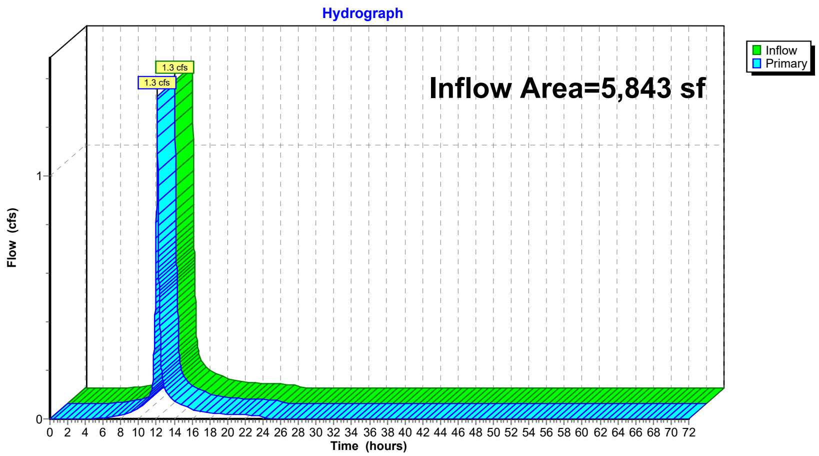


Summary for Link 2L: Towards Street

Inflow Area = 5,843 sf, 18.07% Impervious, Inflow Depth = 8.69" for 100-Year event
Inflow = 1.3 cfs @ 12.09 hrs, Volume= 4,233 cf
Primary = 1.3 cfs @ 12.09 hrs, Volume= 4,233 cf, Atten= 0%, Lag= 0.0 min
Routed to Link 100L : Total Flows

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 2L: Towards Street

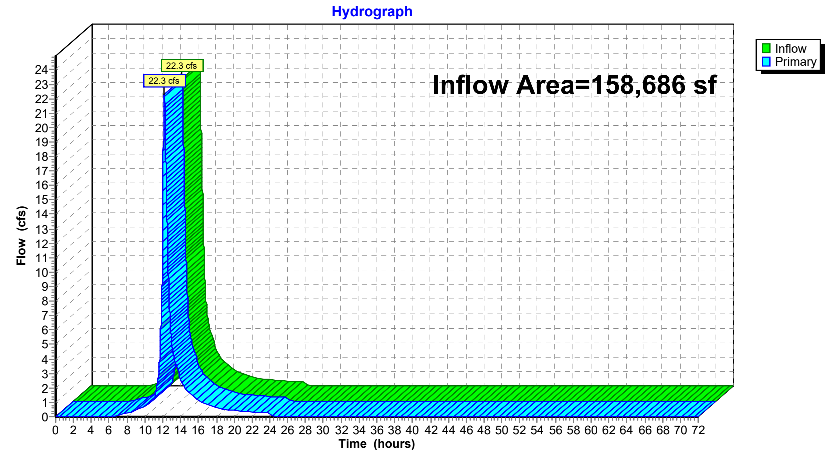


Summary for Link 100L: Total Flows

Inflow Area = 158,686 sf, 49.59% Impervious, Inflow Depth = 8.31" for 100-Year event
Inflow = 22.3 cfs @ 12.18 hrs, Volume= 109,893 cf
Primary = 22.3 cfs @ 12.18 hrs, Volume= 109,893 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 100L: Total Flows



SECTION 6.0

ADDITIONAL DRAINAGE CALCULATIONS

6.01 TSS Removal Calculations

TSS Removal Calculation Worksheet

Location: Thorndike Place, Arlington, MA

Project: 23407.02

BSC GROUP

Prepared By: E. Derrig

Date: 12/09/2024

AREA 1 - CB-1

Total Impervious Area, Acres= 0.377

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
Deep Sump and Hooded Catchbasins	0.25	1.00	0.25	0.75
Hydrodynamic Separator	0.7	0.75	0.53	0.23
Infiltration Basin	0.8	0.23	0.18	0.05

TSS Removal = 0.96

AREA 2A - TD-1A

Total Impervious Area, Acres= 0.027

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
Hydrodynamic Separator	0.7	1.00	0.70	0.30
Infiltration Basin	0.8	0.30	0.24	0.06

TSS Removal = 0.94

AREA 2B - TD-1B

Total Impervious Area, Acres= 0.044

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
Hydrodynamic Separator	0.7	1.00	0.70	0.30

TSS Removal = 0.70

AREA 3 - TD-2-6

Total Impervious Area, Acres= 0.122

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
Infiltration Basin	0.8	1.00	0.80	0.20

TSS Removal = 0.80

AREA 4 - Bypass to Street

Total Impervious Area, Acres= 0.024

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
		1.00		

TSS Removal =

AREA 5 - East Driveway

Total Impervious Area, Acres= 0.148

A	B	C	D	E
BMP	TSS Removal Rate	Starting TSS Load*	Amount Removed (BxC)	Remaining Load (C-D)
Rain Garden	0.8	1.00	0.80	0.20

TSS Removal = 0.80

Weighted Annual Average TSS Removal Rate

[TSS Removal-1 (Area-1) + TSS Revoval-2 (Area-2)+ ….] / [Area-1 + Area-2 + ...] = 0.85

Project Site TSS Removal = 0.85

6.02 GROUNDWATER RECHARGE VOLUME CALCULATIONS

Required Recharge Volume

Rv = F x Impervious Area

Where:

Rv = Recharge Volume

F=Target Depth Factor associated with each Hydrologic Soil Group

(F=0.25-inch for Soil Type C)

Impervious Area = Proposed Pavement and Rooftop area on-site

$$Rv = \left(\frac{0.25in}{12}\right)(78{,}689sft) =$$

Rv = 1,640 cf (required recharge volume)

As not all impervious surfaces are directed to an infiltration BMP, an adjusted Required Volume must be provided. The adjusted Required Volume (Rva) is calculated as:

$$Rva = \frac{Total\ Imp.Area}{Imp.Area\ to\ BMP}\ (\text{Rv}) =$$

$$Rva = \left(\frac{78{,}689sft}{75{,}617sft}\right)(1{,}640cf) =$$

$$Rva = 1{,}707\ cf$$

Storage Provided

- Underground Infiltration System 1 = 7,826 cubic feet provided
- Underground Infiltration System 2 = 122 cubic feet provided
- Underground Infiltration System 3/4 = 254 cubic feet provided (systems are the same)
- Underground Infiltration System 5/6 = 218 cubic feet provided (systems are the same)
- Underground Infiltration System 7 = 417 cubic feet provided
- **Underground Infiltration Systems Total = 8,837 cubic feet provided > 1,707 cf required**
  Rain garden not required to meet volume, but provides additional infiltration above and beyond that required.
  Refer to the HydroCAD storage table provided for more information.

Stage-Area-Storage for Pond 1P: Inf Syst-1

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
8.00	**7,459**	0	8.52	7,459	3,336
8.01	7,459	64	8.53	7,459	3,400
8.02	7,459	128	8.54	7,459	3,464
8.03	7,459	192	8.55	7,459	3,528
8.04	7,459	257	8.56	7,459	3,592
8.05	7,459	321	8.57	7,459	3,657
8.06	7,459	385	8.58	7,459	3,721
8.07	7,459	449	8.59	7,459	3,785
8.08	7,459	513	8.60	7,459	3,849
8.09	7,459	577	8.61	7,459	3,913
8.10	7,459	641	8.62	7,459	3,977
8.11	7,459	706	8.63	7,459	4,041
8.12	7,459	770	8.64	7,459	4,106
8.13	7,459	834	8.65	7,459	4,170
8.14	7,459	898	8.66	7,459	4,234
8.15	7,459	962	8.67	7,459	4,298
8.16	7,459	1,026	8.68	7,459	4,362
8.17	7,459	1,091	8.69	7,459	4,426
8.18	7,459	1,155	8.70	7,459	4,490
8.19	7,459	1,219	8.71	7,459	4,555
8.20	7,459	1,283	8.72	7,459	4,619
8.21	7,459	1,347	8.73	7,459	4,683
8.22	7,459	1,411	8.74	7,459	4,747
8.23	7,459	1,475	8.75	7,459	4,811
8.24	7,459	1,540	8.76	7,459	4,875
8.25	7,459	1,604	8.77	7,459	4,940
8.26	7,459	1,668	8.78	7,459	5,004
8.27	7,459	1,732	8.79	7,459	5,068
8.28	7,459	1,796	8.80	7,459	5,132
8.29	7,459	1,860	8.81	7,459	5,196
8.30	7,459	1,924	8.82	7,459	5,260
8.31	7,459	1,989	8.83	7,459	5,324
8.32	7,459	2,053	8.84	7,459	5,389
8.33	7,459	2,117	8.85	7,459	5,453
8.34	7,459	2,181	8.86	7,459	5,517
8.35	7,459	2,245	8.87	7,459	5,581
8.36	7,459	2,309	8.88	7,459	5,645
8.37	7,459	2,374	8.89	7,459	5,709
8.38	7,459	2,438	8.90	7,459	5,773
8.39	7,459	2,502	8.91	7,459	5,838
8.40	7,459	2,566	8.92	7,459	5,902
8.41	7,459	2,630	8.93	7,459	5,966
8.42	7,459	2,694	8.94	7,459	6,030
8.43	7,459	2,758	8.95	7,459	6,094
8.44	7,459	2,823	8.96	7,459	6,158
8.45	7,459	2,887	8.97	7,459	6,223
8.46	7,459	2,951	8.98	7,459	6,287
8.47	7,459	3,015	8.99	7,459	6,351
8.48	7,459	3,079	9.00	7,459	6,415
8.49	7,459	3,143	9.01	7,459	6,479
8.50	7,459	3,207	9.02	7,459	6,543
8.51	7,459	3,272	9.03	7,459	6,607

Stage-Area-Storage for Pond 1P: Inf Syst-1 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
9.04	7,459	6,672	9.56	7,459	10,007
9.05	7,459	6,736	9.57	7,459	10,071
9.06	7,459	6,800	9.58	7,459	10,136
9.07	7,459	6,864	9.59	7,459	10,200
9.08	7,459	6,928	9.60	7,459	10,264
9.09	7,459	6,992	9.61	7,459	10,328
9.10	7,459	7,056	9.62	7,459	10,392
9.11	7,459	7,121	9.63	7,459	10,456
9.12	7,459	7,185	9.64	7,459	10,521
9.13	7,459	7,249	9.65	7,459	10,585
9.14	7,459	7,313	9.66	7,459	10,649
9.15	7,459	7,377	9.67	7,459	10,713
9.16	7,459	7,441	9.68	7,459	10,777
9.17	7,459	7,505	9.69	7,459	10,841
9.18	7,459	7,570	9.70	7,459	10,905
9.19	7,459	7,634	9.71	7,459	10,970
9.20	7,459	7,698	9.72	7,459	11,034
9.21	7,459	7,762	9.73	7,459	11,098
9.22	7,459	7,826	9.74	7,459	11,162
9.23	7,459	7,890	9.75	7,459	11,226
9.24	7,459	7,955	9.76	7,459	11,290
9.25	7,459	8,019	9.77	7,459	11,354
9.26	7,459	8,083	9.78	7,459	11,419
9.27	7,459	8,147	9.79	7,459	11,483
9.28	7,459	8,211	9.80	7,459	11,547
9.29	7,459	8,275	9.81	7,459	11,611
9.30	7,459	8,339	9.82	7,459	11,675
9.31	7,459	8,404	9.83	7,459	11,739
9.32	7,459	8,468	9.84	7,459	11,804
9.33	7,459	8,532	9.85	7,459	11,868
9.34	7,459	8,596	9.86	7,459	11,932
9.35	7,459	8,660	9.87	7,459	11,996
9.36	7,459	8,724	9.88	7,459	12,060
9.37	7,459	8,788	9.89	7,459	12,124
9.38	7,459	8,853	9.90	7,459	12,188
9.39	7,459	8,917	9.91	7,459	12,253
9.40	7,459	8,981	9.92	7,459	12,317
9.41	7,459	9,045	9.93	7,459	12,381
9.42	7,459	9,109	9.94	7,459	12,445
9.43	7,459	9,173	9.95	7,459	12,509
9.44	7,459	9,238	9.96	7,459	12,573
9.45	7,459	9,302	9.97	7,459	12,637
9.46	7,459	9,366	9.98	7,459	12,702
9.47	7,459	9,430	9.99	7,459	12,766
9.48	7,459	9,494	10.00	7,459	12,830
9.49	7,459	9,558	10.01	7,459	12,894
9.50	7,459	9,622	10.02	7,459	12,958
9.51	7,459	9,687	10.03	7,459	13,022
9.52	7,459	9,751	10.04	7,459	13,087
9.53	7,459	9,815	10.05	7,459	13,151
9.54	7,459	9,879	10.06	7,459	13,215
9.55	7,459	9,943	10.07	7,459	13,279

Stage-Area-Storage for Pond 4P: Inf Syst-2 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
9.08	101	113
9.09	101	114
9.10	101	115
9.11	101	115
9.12	101	116
9.13	101	116
9.14	101	117
9.15	101	117
9.16	101	118
9.17	101	118
9.18	101	119
9.19	101	120
9.20	101	120
9.21	101	121
9.22	101	121
9.23	101	122
9.24	101	122
9.25	101	122
9.26	101	123
9.27	101	123
9.28	101	124
9.29	101	124
9.30	101	125
9.31	101	125
9.32	101	125
9.33	101	126
9.34	101	126
9.35	101	127
9.36	101	127
9.37	101	127
9.38	101	128
9.39	101	128
9.40	101	129
9.41	101	129
9.42	101	129
9.43	101	130
9.44	101	130
9.45	101	131
9.46	101	131
9.47	101	131
9.48	101	132
9.49	101	132
9.50	101	133
9.51	101	133
9.52	101	133
9.53	101	134
9.54	101	134
9.55	101	135
9.56	101	135
9.57	101	135
9.58	101	136
9.59	101	136
9.60	101	137
9.61	101	137
9.62	101	137
9.63	101	138
9.64	101	138
9.65	101	139
9.66	101	139
9.67	101	139
9.68	101	140
9.69	101	140
9.70	101	141
9.71	101	141
9.72	101	**141**
9.73	101	141

Stage-Area-Storage for Pond 5P: Inf Syst-3 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
9.08	101	113
9.09	101	114
9.10	101	115
9.11	101	115
9.12	101	116
9.13	101	116
9.14	101	117
9.15	101	117
9.16	101	118
9.17	101	118
9.18	101	119
9.19	101	120
9.20	101	120
9.21	101	121
9.22	101	121
9.23	101	122
9.24	101	122
9.25	101	122
9.26	101	123
9.27	101	123
9.28	101	124
9.29	101	124
9.30	101	125
9.31	101	125
9.32	101	125
9.33	101	126
9.34	101	126
9.35	101	127
9.36	101	127
9.37	101	127
9.38	101	128
9.39	101	128
9.40	101	129
9.41	101	129
9.42	101	129
9.43	101	130
9.44	101	130
9.45	101	131
9.46	101	131
9.47	101	131
9.48	101	132
9.49	101	132
9.50	101	133
9.51	101	133
9.52	101	133
9.53	101	134
9.54	101	134
9.55	101	135
9.56	101	135
9.57	101	135
9.58	101	136
9.59	101	136
9.60	101	137
9.61	101	137
9.62	101	137
9.63	101	138
9.64	101	138
9.65	101	139
9.66	101	139
9.67	101	139
9.68	101	140
9.69	101	140
9.70	101	141
9.71	101	141
9.72	101	**141**
9.73	101	141
9.74	101	141
9.75	101	141
9.76	101	141
9.77	101	141
9.78	101	141
9.79	101	141
9.80	101	141
9.81	101	141
9.82	101	141
9.83	101	141
9.84	101	141
9.85	101	141
9.86	101	141
9.87	101	141

Stage-Area-Storage for Pond 7P: Inf Syst-5

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
7.00	**101**	0
7.05	101	2
7.10	101	4
7.15	101	6
7.20	101	8
7.25	101	10
7.30	101	13
7.35	101	16
7.40	101	19
7.45	101	21
7.50	101	24
7.55	101	27
7.60	101	30
7.65	101	33
7.70	101	35
7.75	101	38
7.80	101	41
7.85	101	44
7.90	101	47
7.95	101	50
8.00	101	52
8.05	101	55
8.10	101	58
8.15	101	61
8.20	101	64
8.25	101	67
8.30	101	69
8.35	101	72
8.40	101	75
8.45	101	78
8.50	101	81
8.55	101	83
8.60	101	86
8.65	101	89
8.70	101	92
8.75	101	95
8.80	101	98
8.85	101	100
8.90	101	103
8.95	101	106
9.00	101	109
9.05	101	112
9.10	101	114
9.15	101	116
9.20	101	118
9.25	101	120
9.30	101	122
9.35	101	**124**
9.40	101	**125**
9.45	101	125
9.50	101	125

Stage-Area-Storage for Pond 9P: Inf Syst-7

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
7.15	**2,422**	0	8.19	2,422	2,166
7.17	2,422	42	8.21	2,422	2,208
7.19	2,422	83	8.23	2,422	2,249
7.21	2,422	125	8.25	2,422	2,291
7.23	2,422	167	8.27	2,422	2,333
7.25	2,422	208	8.29	2,422	2,374
7.27	2,422	250	8.31	2,422	2,416
7.29	2,422	292	8.33	2,422	2,458
7.31	2,422	333	8.35	2,422	2,499
7.33	2,422	375	8.37	2,422	2,541
7.35	2,422	417	8.39	2,422	2,583
7.37	2,422	458	8.41	2,422	2,624
7.39	2,422	500	8.43	2,422	2,666
7.41	2,422	542	8.45	2,422	2,708
7.43	2,422	583	8.47	2,422	2,749
7.45	2,422	625	8.49	2,422	2,791
7.47	2,422	666	8.51	2,422	2,833
7.49	2,422	708	8.53	2,422	2,874
7.51	2,422	750	8.55	2,422	2,916
7.53	2,422	791	8.57	2,422	2,958
7.55	2,422	833	8.59	2,422	2,999
7.57	2,422	875	8.61	2,422	3,041
7.59	2,422	916	8.63	2,422	3,083
7.61	2,422	958	8.65	2,422	3,124
7.63	2,422	1,000	8.67	2,422	3,166
7.65	2,422	1,041	8.69	2,422	3,207
7.67	2,422	1,083	8.71	2,422	3,249
7.69	2,422	1,125	8.73	2,422	3,291
7.71	2,422	1,166	8.75	2,422	3,332
7.73	2,422	1,208	8.77	2,422	3,374
7.75	2,422	1,250	8.79	2,422	3,416
7.77	2,422	1,291	8.81	2,422	3,457
7.79	2,422	1,333	8.83	2,422	3,499
7.81	2,422	1,375	8.85	2,422	3,541
7.83	2,422	1,416	8.87	2,422	3,582
7.85	2,422	1,458	8.89	2,422	**3,624**
7.87	2,422	1,500			
7.89	2,422	1,541			
7.91	2,422	1,583			
7.93	2,422	1,625			
7.95	2,422	1,666			
7.97	2,422	1,708			
7.99	2,422	1,750			
8.01	2,422	1,791			
8.03	2,422	1,833			
8.05	2,422	1,875			
8.07	2,422	1,916			
8.09	2,422	1,958			
8.11	2,422	1,999			
8.13	2,422	2,041			
8.15	2,422	2,083			
8.17	2,422	2,124			

Drawdown Within 72-Hours

Pond 1P

Rv = Recharge Volume, 7,826 cu.ft. (see above)

K = Saturated Hydraulic Conductivity, 0.27 in/hr (from Rawls Table) = 0.0225 ft/hr

Bottom Area = Area of Infiltration System Bottom, 7,459 sq.ft. (see HydroCAD)

$$Time = \frac{Rv}{(K)(Bottom\ Area)}$$

$$Time = \left(\frac{7{,}826\ cu.ft.}{(0.0225\ ft/hr)(7{,}459 sq.ft.)}\right) =$$

$$Time = 46.6\ hours$$

- 46.6 hours < 72 hours

Pond 3P (Rain Garden)

Rv = Recharge Volume, 190 cu.ft. (see HydroCAD)

K = Saturated Hydraulic Conductivity, 0.27 in/hr (from Rawls Table) = 0.0225 ft/hr

Bottom Area = Area of Infiltration System Bottom, 125 sq.ft. (see HydroCAD)

$$Time = \frac{Rv}{(K)(Bottom\ Area)}$$

$$Time = \left(\frac{190\ cu.ft.}{(0.0225\ ft/hr)(125 sq.ft.)}\right) =$$

$$Time = 67.6\ hours$$

- 67.6 hours < 72 hours

Pond 4P-6P (Townhouse Trench Drain Infiltration Systems)
Same bottom area, worst case provided

Rv = Recharge Volume, 127 cu.ft. (see above)

K = Saturated Hydraulic Conductivity, 0.27 in/hr (from Rawls Table) = 0.0225 ft/hr

Bottom Area = Area of Infiltration System Bottom, 100.75 sq.ft.

$$Time = \frac{Rv}{(K)(Bottom\ Area)}$$

$$Time = \left(\frac{127\ cu.ft.}{(0.0225\ ft/hr)(100.75 sq.ft.)}\right) =$$

$$Time = 56.0\ hours$$

- 56.0 hours < 72 hours

Pond 7P

Rv = Recharge Volume, 417 cu.ft (see HydroCAD)

K = Saturated Hydraulic Conductivity, 0.27 in/hr (from Rawls Table) = 0.0225 ft/hr

Bottom Area = Area of Infiltration System Bottom, 2,421.8 sq.ft.

$$Time = \frac{Rv}{(K)(Bottom\ Area)}$$

$$Time = \left(\frac{417\ cu.ft.}{(0.0225\ ft/hr)(2{,}421 sq.ft.)}\right) =$$

$$Time = 7.7\ hours$$

- 7.7 hours < 72 hours

6.03 WATER QUALITY VOLUME CALCULATIONS

Water Quality Volume Calculation

V_{WQ} = (D_{WQ}/12 inches/foot) * (A_{IMP} square feet)

V_{WQ} = Required Water Quality Volume (in cubic feet)
D_{WQ} = Water Quality Depth: **0.5-inch**
A_{IMP} = Total Impervious Area (in acres) used for driveways, parking, etc.

Underground Infiltration Systems and Bio-Retention Areas

A_{IMP} = 32,590 sq.ft.

V_{WQ} = (0.5 inches/12 inches/foot) * (32,590 sq.ft.)

V_{WQ} = 1,358 cubic feet (required volume)

Provided volume = 8,783 cubic feet in Underground Infiltration System (refer to the HydroCAD storage tables provided in groundwater recharge section)

6.04 RIP-RAP OUTLET PROTECTION SIZING

OUTLET PROTECTION SIZING

Project No.	23407.02	**Calc By**	EAD
Subject	Outlet Protection Sizing Calcs	**Date**	12/16/2024
Location	Arlington, MA	**Checked by**	DRR
		Date	12/16/2024

FES-1

Q=Design Discharge, (ft^3/s) = 11.1 cfs

D=Culvert Diameter, (ft) = 1.50 ft

TW=Tailwater Depth, (ft) = 0.6 ft, (0.4xD for unknow tailwater, or enter known tailwater)

(Tailwater depth is to be limited to between 0.4D and 1.0D)

Riprap Rock Sizing

$$D_{50} = 0.2D\left[\frac{Q}{\sqrt{g}D^{2.5}}\right]^{4/3}\left[\frac{D}{TW}\right]$$

g=32.2 fps

D_{50} = median rock size, ft

$$D_{50} = 0.28 \left|\frac{11.10}{15.64}\right|^{(4/3)} \left|\frac{1.50}{0.60}\right| = 0.44 \text{ ft}$$

= **5.32 inches**

Table 1 : Riprap Classes and Apron Dimensions

Class	D_{50} (in)	Apron Length	Apron Depth	
1	5	4D	$3.5D_{50}$	
2	**6**	**4D**	**$3.5D_{50}$**	**Use Class 2**
3	10	5D	$3.3D_{50}$	
4	14	6D	$2.2D_{50}$	
5	20	7D	$2.0D_{50}$	
6	22	8D	$2.0D_{50}$	

Apron Dimensions

Length, L=5D = **8 ft**

Depth=$3.3D_{50}$ = **19.80 Inches**

Width=3D+(2/3)L = **9.50 ft** (at apron end)

Riprap Rock Sizing Gradation

Given Size	Size of Stone, inches		
100	**9**	to	**12**
85	**8**	to	**11**
50	**6**	to	**9**
15	**3**	to	**8**

Reference Note: Sizing based in accordance with HEC #14 as required by MassHighway Design Manual

6.05 GROUNDWATER MOUNDING ANALYSIS

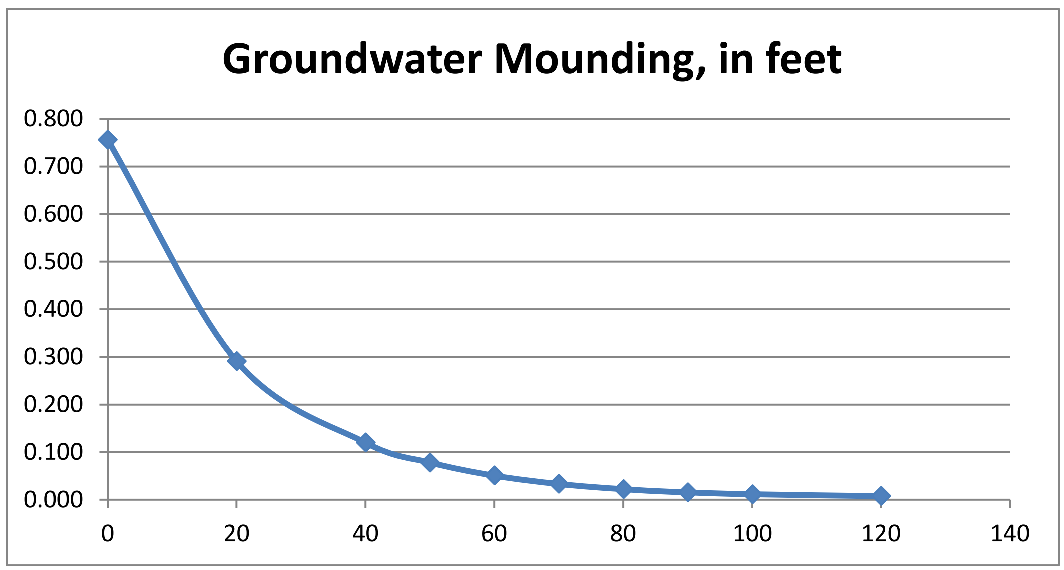
Input Values			inch/hour	feet/day	
1.5979	*R*	Recharge (infiltration) rate (feet/day)	0.67	1.33	
0.080	Sy	Specific yield, Sy (dimensionless, between 0 and 1)			
5.40	K	Horizontal hydraulic conductivity, Kh (feet/day)*	2.00	4.00	In the repor
6.920	x	1/2 length of basin (x direction, in feet)			(USGS SIR 2(
3.640	y	1/2 width of basin (y direction, in feet)	hours	days	(ft/d) is assu
1.000	t	duration of infiltration period (days)	36	1.50	hydraulic co
16.000	hi(0)	initial thickness of saturated zone (feet)			

16.756	h(max)	maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
0.756	Δh(max)	maximum groundwater mounding (beneath center of basin at end of infiltration period)

ESHGW=4.0
Bot System=7.0
Separation=3.0
Mound=0.756 < 3.0

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
0.756	0
0.291	20
0.120	40
0.078	50
0.051	60
0.033	70
0.022	80
0.015	90
0.012	100
0.008	120

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

Recharge/Infiltration Rate (ft/day) = [Required Recharge Volume (cft)/Bottom Recharge System (sft)]/Duration (day)

100 year recharge volume	161	cft
Bottom Recharge System	100.755	sft
Duration	1	day
Recharge/Infiltration Rate	**1.5979**	**ft/day**

Horizontal Hydraulic Conductivity (ft/day) = [Rawls Rate (in/hr) * (1ft/12in) * (24hr/1day)] * 10

Rawls Rate (silt loam)	0.27	in/hr
Horizontal Hydraulic Conductivity	**5.40**	**ft/day**

NOTE: All driveway infiltration systems are the same size and have the same discarded volume in the 100-year event

Summary for Pond 8P: Inf Syst-6

Inflow Area = 1,056 sf, 99.24% Impervious, Inflow Depth = 11.26" for 100-Year event
Inflow = 0.3 cfs @ 12.08 hrs, Volume= 991 cf
Outflow = 0.3 cfs @ 12.09 hrs, Volume= 990 cf, Atten= 0%, Lag= 0.5 min
Discarded = 0.0 cfs @ 1.08 hrs, Volume= 161 cf
Primary = 0.3 cfs @ 12.09 hrs, Volume= 828 cf
Routed to Pond 1P : Underground Infiltration System

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 9.35' @ 12.09 hrs Surf.Area= 101 sf Storage= 124 cf

Plug-Flow detention time= 277.9 min calculated for 990 cf (100% of inflow)
Center-of-Mass det. time= 277.4 min (1,014.7 - 737.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	7.00'	73 cf	**7.28'W x 13.84'L x 2.39'H Field A** 241 cf Overall - 58 cf Embedded = 182 cf x 40.0% Voids
#2A	7.25'	52 cf	**Ferguson R-Tank XD 11** x 10 Inside #1 Inside= 19.7"W x 21.7"H => 2.66 sf x 1.97'L = 5.2 cf Outside= 19.7"W x 21.7"H => 2.96 sf x 1.97'L = 5.8 cf 10 Chambers in 2 Rows
		125 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.00'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	9.00'	**8.0" Round Culvert** L= 46.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 9.00' / 8.77' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.35 sf

Discarded OutFlow Max=0.0 cfs @ 1.08 hrs HW=7.03' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=0.3 cfs @ 12.09 hrs HW=9.35' (Free Discharge)
└─**2=Culvert** (Barrel Controls 0.3 cfs @ 2.11 fps)

Infiltration System 7

Input Values

			inch/hour	feet/day
0.6631	*R*	**Recharge (infiltration) rate (feet/day)**	0.67	1.33
0.080	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**		
5.40	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***	2.00	4.00
17.225	**x**	**1/2 length of basin (x direction, in feet)**		
35.150	**y**	**1/2 width of basin (y direction, in feet)**	**hours**	**days**
1.000	**t**	**duration of infiltration period (days)**	36	1.50
16.000	**hi(0)**	**initial thickness of saturated zone (feet)**		

In the repor
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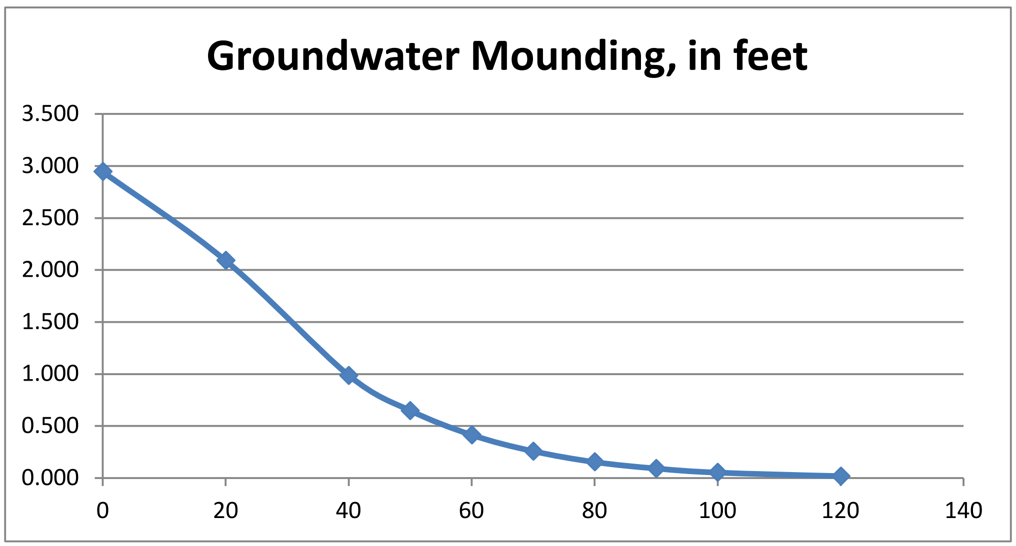
(ft/d) is assu
hydraulic co

18.946	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
2.946	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

ESHGW=4.0
Bottom System=7.15
Separation=3.15
Mound=2.946 < 3.15

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
2.946	**0**
2.091	**20**
0.985	**40**
0.647	**50**
0.413	**60**
0.256	**70**
0.154	**80**
0.091	**90**
0.052	**100**
0.017	**120**

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

Recharge/Infiltration Rate (ft/day) = [Required Recharge Volume (cft)/Bottom Recharge System (sft)]/Duration (day)

100 year recharge volume	1,606	cft
Bottom Recharge System	2,421.835	sft
Duration	1	day
Recharge/Infiltration Rate	**0.6631**	**ft/day**

Horizontal Hydraulic Conductivity (ft/day) = [Rawls Rate (in/hr) * (1ft/12in) * (24hr/1day)] * 10

Rawls Rate (silt loam)	0.27	in/hr
Horizontal Hydraulic Conductivity	**5.40**	**ft/day**

Summary for Pond 9P: Inf Syst-7

Inflow Area = 24,698 sf, 71.15% Impervious, Inflow Depth = 10.36" for 100-Year event
Inflow = 6.3 cfs @ 12.08 hrs, Volume= 21,328 cf
Outflow = 3.5 cfs @ 12.20 hrs, Volume= 21,328 cf, Atten= 45%, Lag= 7.1 min
Discarded = 0.0 cfs @ 3.69 hrs, Volume= 1,606 cf
Primary = 3.5 cfs @ 12.20 hrs, Volume= 19,722 cf
Routed to Link 1L : Towards Wetlands

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 8.89' @ 12.20 hrs Surf.Area= 2,422 sf Storage= 3,633 cf

Plug-Flow detention time= 43.0 min calculated for 21,325 cf (100% of inflow)
Center-of-Mass det. time= 43.1 min (806.8 - 763.8)

Volume	Invert	Avail.Storage	Storage Description
#1	7.15'	5,207 cf	**6.89'W x 14.06'L x 2.50'H StormTrap ST-1 Units (Irregular Shape)** x 25 6,055 cf Overall x 86.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Discarded	7.15'	**0.270 in/hr Exfiltration over Surface area**
#2	Primary	7.15'	**12.0" Round Culvert** L= 4.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 7.15' / 7.13' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#3	Device 2	7.35'	**22.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.0 cfs @ 3.69 hrs HW=7.18' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.0 cfs)

Primary OutFlow Max=3.5 cfs @ 12.20 hrs HW=8.89' (Free Discharge)
└─**2=Culvert** (Passes 3.5 cfs of 4.2 cfs potential flow)
  └─**3=Orifice/Grate** (Orifice Controls 3.5 cfs @ 5.65 fps)

Specific Yield--

Compilation of Specific Yields for Various Materials

GEOLOGICAL SURVEY WATER SUPPLY PAPER 1662-D

Prepared in cooperation with the California Department of Water Resources

TABLE 29.—*Compilation of specific yields for various materials*

[All values rounded off to nearest whole percentage]

Material	Valley fill, California (Eckis, 1934)	Mokelumne area, California (Piper and others, 1939)	Santa Ynez River basin, California (Upson and Thomasson, 1951)	Sacramento Valley, Calif. (Poland and others, 1949)	Smith River plain, California (Back, 1957)	Ventura County, Calif. (Calif. Water Resources Board, 1956)	Santa Margarita Valley, Calif. (Calif. Dept. Public Works, 1956)	Tia Juana Basin, Calif. (Calif. Water Rights Board, 1957)	San Luis Obispo County, Calif. (Calif. Water Resources Board, 1958)	San Joaquin Valley, Calif. (Davis and others, 1959)	Eureka area, California (Evenson, 1959)	Santa Ynez Basin, Calif. (Wilson, 1959)	Rechna Doab, Pakistan (Kazmi, 1961)	Napa-Sonoma Valleys, Calif. (Kunkel and Upson, 1960)	Humboldt River Valley, Nev. (Cohen, 1963)	Unconsolidated alluvium (Preuss and Todd, 1963)	Little Bighorn River valley, Montana (Moulder and Others, 1960)	Average specific yield
Clay	1	4	2	3	1	0	1	1	3	3	3	5	3	3	1	-----	-----	2
Silt	10	4	12	3	-----	3	10	10	5	5	10	5	5	5	19	4	17	8
Sandy clay	10	4	12	3	5	5	5	5	5	5	10	-----	-----	10	-----	-----	-----	7
Fine sand	21	26	12	10	10	25	28	25	25	10	20	20	27	20	26	23	32	21
Medium sand	31	26	30	20	15	25	28	30	25	25	20	30	28	20	28	28	32	26
Coarse sand	31	35	35	20	25	25	28	32	25	25	20	30	23	20	27	28	32	27
Gravelly sand	31	35	35	20	25	21	22	28	21	25	20	-----	23	20	-----	22	32	25
Fine gravel	27	35	35	25	25	21	22	26	21	25	25	25	26	25	19	17	25	25
Medium gravel	21	-----	-----	25	25	21	22	23	21	25	25	25	26	25	-----	13	25	23
Coarse gravel	14	-----	-----	25	25	21	22	18	21	25	25	25	26	25	-----	12	-----	22

APPENDIX G

MCPHAIL GEOTECHNICAL MEMORANDUM

Memorandum

Date:	December 9, 2024
Recipient:	Arlington Land Manager LLC c/o Dinosaur Capital Partners LLC – Scott Oran
Sender:	Scott S. Smith, P.E.
Project:	Thorndike Place; Arlington, MA
Project No:	7679.2.01
Subject:	Subsurface Conditions at Proposed Stormwater Infiltration System

Background

This memorandum documents the subsurface soil and groundwater conditions encountered in the borings performed at the Thorndike Place project site during November 2024. The purpose of the borings was to provide supplemental information to the project civil engineer related to stormwater infiltration system design, including the saturated soil thickness within the footprint of the proposed stormwater infiltration system.

The 5.8-acre subject property is bounded by Dorothy Road and residences to the north, residences and undeveloped conservation land to the east, undeveloped conservation land to the south and the Concord Turnpike (Route 2) to the west. The subject property is currently unoccupied, undeveloped wooded land. Refer to the Project Location Plan, Figure 1, for the general site locus.

Based on the information provided to us, the proposed development is planned to consist of six (6), 3-story townhouses with footprints of about 1,700 square feet that are planned to include basements, and a 4-story multi-family residential building with a footprint of about 33,000 square feet that is planned to have 1-level of below-grade parking.

It is understood that as part of the proposed development, a stormwater infiltration system with a footprint of about 8,100 square feet will be constructed within the western portion of the site.

Elevations cited herein are in feet and are referenced to the North American Vertical Datum of 1988 (NAVD88).

Subsurface Explorations

The approximate locations of the subsurface explorations are indicated on the enclosed Subsurface Exploration Plan, Figure 2. The following subsurface explorations were completed at the project site under contract to McPhail:

- Two (2) borings (MA-1 through MA-2) were completed on November 20, 2024 by Carr-Dee Corp. of Medford, Massachusetts.

The borings were drilled to depths ranging from 37 to 42 feet below the existing ground surface and were terminated within a natural marine clay deposit. The boring logs are attached to this memorandum.

Thirteen (13) test pits were previously excavated at the site by others during May 2023 and April 2024. Additionally, four (4) groundwater monitoring wells were installed within completed test pits TP-1, TP-6, TP-7, and TP-9.

Soil Conditions

A detailed description of the subsurface conditions encountered in the explorations is documented on the boring logs attached to this memorandum. The approximate locations of the subsurface explorations are indicated on the enclosed Subsurface Exploration Plan, Figure 2.

Based on the results of the borings performed at the site, the following is a description of the generalized subsurface conditions encountered from ground surface downward.

Generalized Subsurface Strata	*Approximate Thickness (Feet)*	*Top of Soil Strata (Elevation)*
Fill	5.5 to 9.5	El. +7.9 to El. +11.1 (Ground Surface)
Peat	2.5 (At boring MA-2 only)	El. +2.4
Alluvium	12 to 19	El. -0.1 to El. +1.6
Marine Clay	Not Penetrated	El. -17.4 to El. -12.1

Fill Material: The fill material generally consists of compact to dense sand and gravel, trace to some silt, varying to a silt and sand, trace gravel and containing brick, wood, ash and cinders.

Organic Deposit: Underlying the fill at boring MA-2, the organic deposit generally consists of soft to firm, brown fibrous peat. The organic deposit was not encountered in boring MA-1 and appears to be discontinuous between MA-1 and MA-2.

Alluvium Deposit: Underlying the fill at boring MA-1 and the organic deposit at boring MA-2, the alluvium deposit generally consists of a compact to dense gray-brown stratified silty sand, varying to sand, trace silt.

Memorandum

Marine Clay Deposit: Underlying the alluvium deposit, the marine clay deposit generally consists of a very soft to stiff, gray silty marine clay deposit with occasional to frequent sand lenses of varying thickness. At boring MA-2, an approximate 2.5-foot-thick sand seam was observed from about Elevation -13.1 to Elevation -15.6. The depth to the top of the marine clay deposit was observed at about 28.5 feet and 20 feet below the existing ground surface at MA-1 and MA-2, respectively. The borings were terminated within the marine clay deposit which is anticipated to extend to depths greater than 100 feet below the existing ground surface and be underlain by glacial till and bedrock.

Groundwater Conditions

Where encountered in the borings during drilling, groundwater was observed at depths ranging from about 12 and 11 feet below the existing ground surface at boring MA-1 and MA-2, corresponding to Elevation -0.9 and Elevation -3.1, respectively.

It is anticipated that future groundwater levels across the site may vary from those reported herein due to factors such as normal seasonal changes, runoff particularly during or following periods of heavy precipitation, and alterations of existing drainage patterns.

Summary and Conclusions

The subsurface soil conditions in borings MA-1 and MA-2 consisted of a granular fill material, underlain by a discontinuous peat deposit, underlain by an alluvium deposit, overlying a marine clay deposit. The depth to the top of the marine clay deposit was observed at about 28.5 feet and 20 feet below the existing ground surface, corresponding to Elevation -17.4 and Elevation -12.1 at MA-1 and MA-2, respectively. The marine clay deposit is anticipated to have a low permeability and would be considered a barrier to groundwater flow, typically signifying the bottom of the permeable soils.

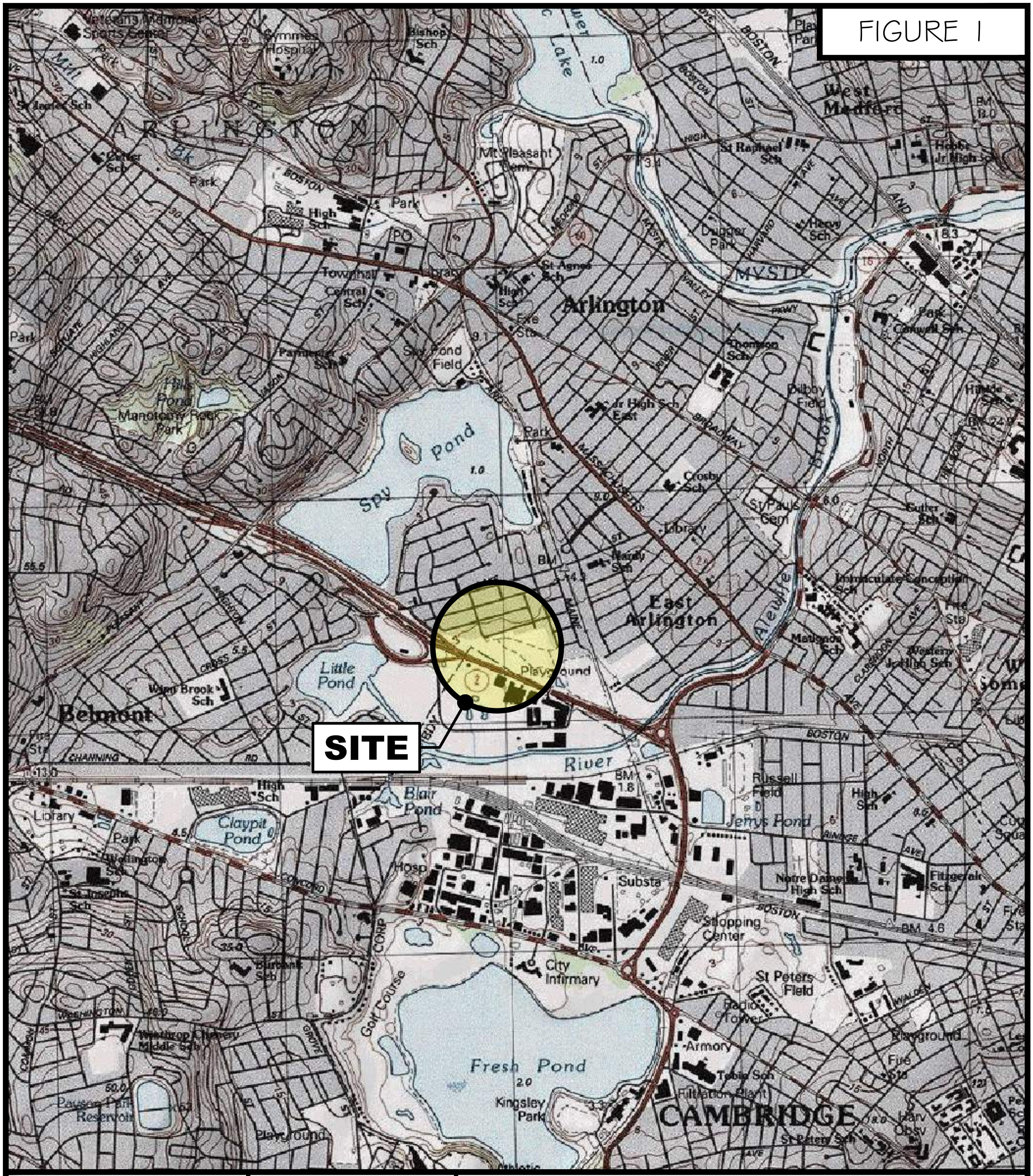
Closing

We trust that the above is sufficient for your present requirements. Should you have any questions concerning the recommendations presented herein, please do not hesitate to contact us.

N:\Working Documents\Jobs\7679 - Thorndike Place\Geotechnical Data Report\7679_ThorndikePlace_GeotechnicalData_Memo-rev2 120924.docx
SSS/ada

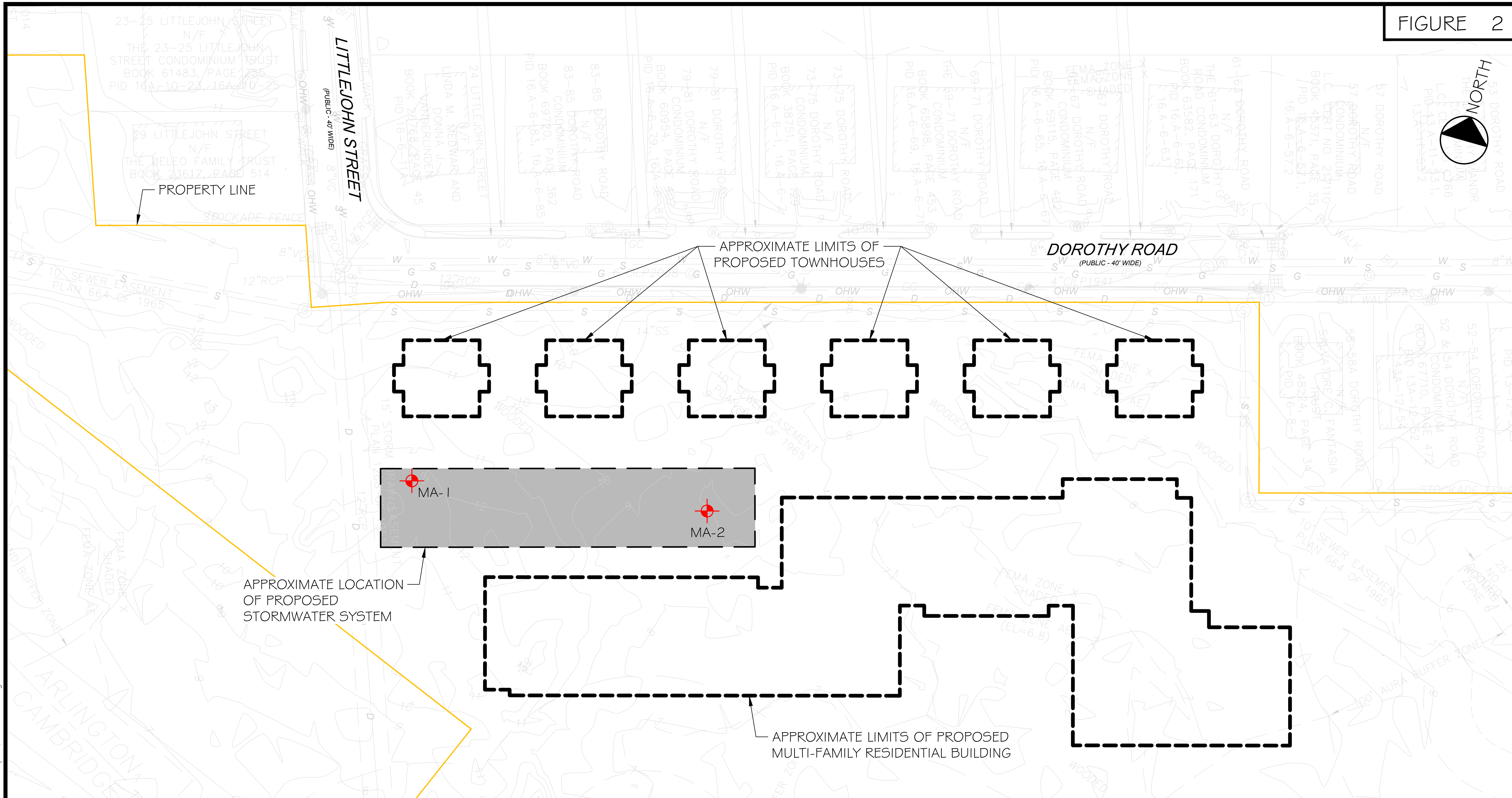
Attachments: Figure 1: Project Location Plan
Figure 2: Subsurface Exploration Plan
Boring Logs

FIGURE 1



McPHAIL ASSOCIATES, LLC 42 3rd Avenue Burlington, MA 01803 617-868-1420 www.mcphailgeo.com	N SCALE 1:25,000	**PROJECT LOCATION PLAN** THORNDIKE PLACE ARLINGTON MASSACHUSETTS

FIGURE 2



LEGEND

— APPROXIMATE LOCATION OF BOREHOLE PERFORMED BY CARR-DEE CORP. ON NOVEMBER 20, 2024 FOR McPHAIL ASSOCIATES, LLC

REFERENCE: THIS PLAN WAS PREPARED FROM AN 80-SCALE DRAWING ENTITLED "EXISTING CONDITIONS" DATED SEPTEMBER 6, 2023 BY BSC GROUP, INC.

GRAPHIC SCALE

50 0 50 100

McPHAIL ASSOCIATES, LLC
42 3rd Avenue
Burlington, MA 01803
617-868-1420
www.mcphailgeo.com

THORNDIKE PLACE
ARLINGTON MASSACHUSETTS
SUBSURFACE EXPLORATION PLAN
FOR
DINOSAUR CAPITAL PARTNERS LLC
BY
McPHAIL ASSOCIATES, LLC

Date: DECEMBER 2024	Dwn: I.J.M.	Chkd: S.S.S.	Scale: 1" = 50'
Project No: 7679			

FILE NAME: N:\Acad\JOBS\7679\Geotech Data Report\7679-F02.dwg

Project:	Thorndike Place	**Job #:**	7679.2.01
Location:	See Plan	**Date Started:**	11-20-24
City/State:	Arlington, Massachusetts	**Date Finished:**	11-20-24

Boring No. MA-1

Contractor: Carr-Dee Corp
Driller/Helper: J. DeSimone/C. Smith
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): 11.1

Casing Type/Depth (ft): 2.25" I.D. HSA/NW Casing
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
11-20-24	12	-0.9	

Depth (ft)	Elev. (ft)
1	10
2	9
3	8
4	7
5	6
6	5
7	4
8	3
9	2
10	1
11	0
12	-1
13	-2
14	-3
15	-4
16	-5
17	-6
18	-7
19	-8
20	-9
21	-10
22	-11

Depth/EL to Strata Change (ft)	Stratum	Sample N-Value	Sample No.	Sample Pen. /Rec. (in)	Sample Depth (ft)	Sample Blows Per 6"	Sample Description and Boring Notes
	FILL	12	S-1	24/8	0.0-2.0	3 5 7 12	Compact light brown silty SAND and GRAVEL. (FILL)
		70	S-2	24/16	5.0-7.0	14 37 33 49	Very dense, gray-brown SAND and GRAVEL, trace to some silt to BRICK. (FILL)
9.5 / 1.6							
	ALLUVIUM DEPOSIT	19	S-3	24/0	10.0-12.0	16 12 7 14	No Recovery
		45	S-4	24/14	12.0-14.0	14 23 22 20	Dense, dark gray SAND, trace to some silt. (ALLUVIUM DEPOSIT)
		23	S-5	24/12	15.0-17.0	9 12 11 12	Compact, gray-brown SAND, trace silt. (ALLUVIUM DEPOSIT)
		17	S-6	24/18	20.0-22.0	8 8 9 12	Compact, orange-brown and yellow-brown stratified silty SAND to SAND, trace silt. (ALLUVIUM DEPOSIT)

GRANULAR SOILS

BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS

BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
1. Used Automatic Hammer for SPT.
2. Drillers switched to casing after obtaining sample from 12-14'.

Weather: Variable

McPHAIL ASSOCIATES, LLC
42 3rd AVENUE
Burlington, MA 01803
TEL: 617-868-1420
FAX: 617-868-1423

Project: Thorndike Place	**Job #:** 7679.2.01		Boring No.
Location: See Plan	**Date Started:** 11-20-24		**MA-1**
City/State: Arlington, Massachusetts	**Date Finished:** 11-20-24		

Contractor: Carr-Dee Corp
Driller/Helper: J. DeSimone/C. Smith
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): 11.1

Casing Type/Depth (ft): 2.25" I.D. HSA/NW Casing
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
11-20-24	12	-0.9	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows Per 6"	Sample Description and Boring Notes
24	-13			ALLUVIUM DEPOSIT						
25	-14				33	S-7	24/18	25.0-27.0	19 17 16 15	Dense, gray stratified silty SAND to SAND, trace silt. (ALLUVIUM DEPOSIT)
26	-15									
27	-16									
28	-17		28.5 / -17.4							
29	-18			MARINE CLAY						
30	-19				9	S-8	24/18	30.0-32.0	3 4 5 3	Stiff, gray silty CLAY with ~ 6 inch layer of sand. (MARINE CLAY)
31	-20									
32	-21									
33	-22									
34	-23									
35	-24				1/24"	S-9	24/22	35.0-37.0	1/24"	Very soft, gray silty CLAY. (MARINE CLAY)
36	-25									
37	-26		37.0 / -25.9	Bottom of Borehole at 37.0 feet below existing grade.						
38	-27									
39	-28									
40	-29									
41	-30									
42	-31									
43	-32									
44	-33									
45	-34									

GRANULAR SOILS

BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS

BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
1. Used Automatic Hammer for SPT.
2. Drillers switched to casing after obtaining sample from 12-14'.

Weather: Variable

McPHAIL ASSOCIATES, LLC
42 3rd AVENUE
Burlington, MA 01803
TEL: 617-868-1420
FAX: 617-868-1423

Project:	Thorndike Place	**Job #:**	7679.2.01
Location:	See Plan	**Date Started:**	11-20-24
City/State:	Arlington, Massachusetts	**Date Finished:**	11-20-24

Boring No. MA-2

Contractor: Carr-Dee Corp
Driller/Helper: J. DeSimone/C. Smith
Logged By/Reviewed By: T. M. Cormican
Surface Elevation (ft): 7.9

Casing Type/Depth (ft): 2.25" I.D. HSA/NW Casing
Casing Hammer (lbs)/Drop (in): 300 lbs./24 inches
Sampler Size/Type: 1-3/8" I.D. Split Spoon
Sampler Hammer (lbs)/Drop (in): 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
11-20-24	11	-3.1	

Depth/EL to Strata Change (ft)	Stratum	N-Value	No.	Pen./Rec. (in)	Depth (ft)	Blows Per 6"	Sample Description and Boring Notes
0.4 / 7.5	TOPSOIL	4	S-1	24/16	0.0-2.0	3 2 2 3	Very loose to loose, mottled gray-brown SILT and SAND, trace gravel. (FILL)
5.5 / 2.4	FILL	4	S-2	6/6	5.0-5.5	2	Very loose, mottled orange-brown and black SILT and SAND, with wood, ash and cinders. (FILL)
8.0 / -0.1	ORGANIC DEPOSIT	4	S-2a	18/18	5.5-7.0	2 2 2	Soft to firm, brown FIBROUS PEAT. (ORGANIC DEPOSIT)
	ALLUVIUM DEPOSIT	17	S-3	24/14	10.0-12.0	9 8 9 9	Compact, gray-brown stratified silty SAND to SAND, trace silt. (ALLUVIUM DEOSIT)
20.0 / -12.1		18	S-4	24/16	15.0-17.0	8 8 10 9	Compact, stratified gray silty SAND to SAND, trace silt. (ALLUVIUM DEPOSIT)
21.0 / -13.1	MARINE CLAY	5	S-5	12/12	20.0-21.0	3 2	Very soft to soft, gray silty CLAY with silt and sand seams. (MARINE CLAY)
	MARINE SAND	22	S-5a	12/12	21.0-22.0	8 14	Compact, gray stratified silty SAND to SAND, trace silt. (MARINE SAND)

Depth (ft) / Elev. (ft): 1 / 7, 2 / 6, 3 / 5, 4 / 4, 5 / 3, 6 / 2, 7 / 1, 8 / 0, 9 / -1, 10 / -2, 11 / -3, 12 / -4, 13 / -5, 14 / -6, 15 / -7, 16 / -8, 17 / -9, 18 / -10, 19 / -11, 20 / -12, 21 / -13, 22 / -14

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
1. Used Automatic Hammer for SPT.
2. Drillers switched to casing after obtaining sample from 10-12'.

Weather: Variable

McPHAIL ASSOCIATES, LLC
42 3rd AVENUE
Burlington, MA 01803
TEL: 617-868-1420
FAX: 617-868-1423

Project: Thorndike Place	**Job #:** 7679.2.01	Boring No.
Location: See Plan	**Date Started:** 11-20-24	**MA-2**
City/State: Arlington, Massachusetts	**Date Finished:** 11-20-24	

Contractor: Carr-Dee Corp	**Casing Type/Depth (ft):** 2.25" I.D. HSA/NW Casing
Driller/Helper: J. DeSimone/C. Smith	**Casing Hammer (lbs)/Drop (in):** 300 lbs./24 inches
Logged By/Reviewed By: T. M. Cormican	**Sampler Size/Type:** 1-3/8" I.D. Split Spoon
Surface Elevation (ft): 7.9	**Sampler Hammer (lbs)/Drop (in):** 140 lbs./30 inches

Groundwater Observations

Date	Depth	Elev.	Notes
11-20-24	11	-3.1	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	N-Value	No.	Pen. /Rec. (in)	Depth (ft)	Blows Per 6"	Sample Description and Boring Notes
			23.5 / -15.6	MARINE SAND						
24	-16									
25	-17									
26	-18				2	S-6	24/24	25.0-27.0	1/12' 1 1	Very soft, gray silty CLAY with frequent sand partings in bottom ~ 10 inches of sample. (MARINE CLAY)
27	-19									
28	-20									
29	-21									
30	-22									
31	-23				1	S-7	24/24	30.0-32.0	WOH WOH 1 1	Very soft, gray silty CLAY with frequent sand partings. (MARINE CLAY)
32	-24									
33	-25			MARINE CLAY						
34	-26									
35	-27									
36	-28				1	S-8	24/24	35.0-37.0	WOH WOH 1 1	Very soft, gray silty CLAY, with occasional sand partings. (MARINE CLAY)
37	-29									
38	-30									
39	-31									
40	-32									
41	-33				1	S-9	24/24	40.0-42.0	WOH WOH 1 WOH	Very soft, gray silty CLAY, with occasional sand partings. (MARINE CLAY)
42	-34		42.0 / -34.1							
43	-35			Bottom of Borehole at 42.0 feet below existing grade.						
44	-36									
45	-37									

GRANULAR SOILS

BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS

BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
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"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:
1. Used Automatic Hammer for SPT.
2. Drillers switched to casing after obtaining sample from 10-12'.

Weather: Variable

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JANUARY 2, 2025

Town of Arlington Conservation Commission
c/o Mr. David Morgan, Environmental Planner + Conservation Agent
Robbins Memorial Town Hall
730 Massachusetts Avenue
Arlington, Massachusetts 02476

RE: Restoration Plan and Invasive Species Management Plan
Thorndike Place Residential Development

Dear Members of the Arlington Conservation Commission,

At the previous public hearing on the Project, a Commission member did not recall concluding discussions on the Restoration Plan and Invasive Species Management Plan (ISMP) for the above referenced project. As such, we are providing the following, attached information:

1. A letter to the Commission from Mr. P. Chase Bernier, CWB, PWS, CERP, of SWCA Environmental Consultants (SWCA), dated March 27, 2024, *Re: Notice of Intent Restoration Plan Peer Review – Review of Response to Comments, Thorndike Place, Arlington, Massachusetts*. In this letter, SWCA, as peer review consultant for the Commission, confirms adequate response to all except one of their previous review comments. This letter was submitted by SWCA to the Commission in March 2024.
2. A letter to the Commission from Mr. Matt Burne, PWS, Senior Ecologist at BSC Group (BSC), dated April 4, 2024, *RE: Notice of Intent, SWCA Notice of Intent Restoration Plan Peer Review, Thorndike Place Residential Community, Dorothy Road, Arlington, MA*. In this letter, previously submitted to the Commission, BSC details our response to the lone outstanding comment from SWCA's March 27, 2024, letter.
3. The meeting minutes from the Conservation Commission's April 4, 2024, public meeting on the Project Thorndike Place minutes begin on page 9). We have highlighted two portions of this discussion for reference. On page 11, there is a notation of Chase Bernier of SWCA concurring that Japanese knotweed requires herbicide to treat effectively. On page 12, there is a notation that "The Commission has completed the portion of the hearing dealing with the habitat and invasive management portion of the application, and going forward, will focus on the stormwater portion."

803 Summer Street, Third Floor / Boston, MA 02127 / 617-896-4300

We believe that these documents clearly demonstrate that the peer review on the restoration and ISMP portion of the project is complete and that the Commission has completed discussion on this matter.

Sincerely,
BSC GROUP, INC.

Dominic Rinaldi, PE
Senior Associate

Attachments: March 27, 2024, SWCA Review Letter
April 4, 2024, BSC Response to Review
April 4, 2024, Conservation Commission Meeting Minutes

803 Summer Street, Third Floor / Boston, MA 02127 / 617-896-4300

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March 27, 2024

Ryan Clapp
Arlington Conservation Commission
730 Massachusetts Avenue Annex
Arlington, MA 02476

Re: Notice of Intent Restoration Plan Peer Review – Review of Response to Comments Thorndike Place, Arlington, Massachusetts

Dear Mr. Clapp and Members of the Commission:

SWCA Environmental Consultants (SWCA) submitted a peer review letter report dated January 23, 2024 for a proposed restoration plan as part of the proposed Thorndike Place Residential Community Notice of Intent (NOI). In response to that report, BSC Group, Inc. (BSC), submitted a response to comments letter dated February 7, 2024, including revised plan materials. SWCA completed a review of those responses revised NOI documents on March 6, 2024. BSC submitted additional revised materials for review on March 7, 2024 (Invasive Species Management Plan [ISMP]) and March 12, 2024 (Response to Comments response and revised restoration plans). This correspondence represents SWCA's review of those revised materials.

PROJECT NARRATIVE

Project Activities & Associated Impacts

<u>SWCA Comment 1:</u> Section 3.1.1, second paragraph. The narrative states that dead trees (i.e., snags) that do not provide wildlife habitat will be cut and stumped. Snags provide a wide variety of valuable wildlife habitat functions including shelter and forage opportunities. It is doubtful there are any snags that do not provide any wildlife habitat functions. Additionally, removal of snags does not appear to provide any ecological benefit and stumping of snags within the restoration area would likely result in unnecessary additional impacts (e.g., soil disturbance).

SWCA recommends that this language be revised to indicate that only snags that pose a hazard (e.g., leaning towards the proposed buildings and likely to result in property damage or injury) be removed and that no stumping will occur. SWCA recommends the Commission also consider a condition in the Order of Conditions (OOC), if issued, stating that any snags to be removed shall be approved by the Commission.

<u>BSC Response 1</u>: BSC concurs with the recommended revision and suggests a Special Condition allowing removal of snags from the proposed restoration area that pose a hazard (e.g., leaning toward buildings and/or likely to result in property damage or personal injury) and that no stumping of removed snags shall be permitted. We additionally recommend that the Special Condition allow for a

representative of the Commission be authorized to coordinate, review, and approve any snag removal on behalf of the Commission to avoid construction delays.

SWCA Response 1: SWCA agrees with this response and approach. No further response required.

SWCA Comment 2: Section 3.1.1, second paragraph. The narrative states that an Invasive Species Management Plan (ISMP) for work within resource areas and their buffer zones shall be developed as required by the Comprehensive Permit. During the site walk on January 5, representatives from BSC indicated that invasive species control would be included as part of the proposed restoration efforts. It is unclear how invasive species would be controlled (e.g., mechanical removal, chemical control, etc.) or what the target species would be.

SWCA recommends the Applicant develop a detailed ISMP to be included as part of the NOI that details what the target invasive species will be, proposed specific control methodologies, a monitoring plan to measure invasive vegetation control success, and performance goals. SWCA recommends the ISMP be reviewed by an expert in invasive species removal as some species (e.g., Japanese knotweed [*Reynoutria japonica*]) can be extremely challenging to effectively control.

BSC Response 2: Several invasive plant species occur on the site, most notably Japanese knotweed, oriental bittersweet (*Celastrus orbiculatus*), and garlic mustard (*Alliaria petiolata*). These occur within jurisdictional resource areas and buffer zones, as well as within non-jurisdictional areas of the site.

BSC and the Applicant will prepare an Invasive Species Management Plan (ISMP) to treat invasive plants

currently within the proposed wetland restoration area and to control their spread within the restoration area. BSC recommends that approval of such ISMP by the Commission's representative prior to the start of work be made a Special Condition of an OOC for the project.

SWCA Response 2-1: SWCA recommends that the ISMP be submitted to the Commission and reviewed by an expert in the control of invasive species prior to the issuance of an OOC. Effective control of invasive plants is critical to the success of any ISMP and may require complex management methodologies given the extent and diversity of invasive species on the site. Review of the ISMP prior to OOC issuance ensures the ISMP will be effective and that the Commission has the ability to guarantee that the plan is adequate prior to permit issuance.

BSC Response 2-1: BSC submitted a proposed ISMP for peer review on March 7, 2024.

*SWCA Response 2-2: In SWCA's experience, the most effective way to manage sites similar to the proposed project is to utilize an adaptive management approach. The mechanical, manual, and chemical options appear to be presented as if only one can be chosen for each species. For example, common reed (*Phragmites australis*) and Japanese knotweed, benefit from a combined approach (e.g., cutting first at the appropriate time and then treating with herbicide at the appropriate time. There also appears to be consistent issue throughout the ISMP of misrepresenting the proposed concentrations of herbicide and not mentioning that the chose herbicide label must be followed.*

SWCA recommends the ISMP be adaptative and that sticking to a strict pre-set and unchangeable schedule from year to year is not in the best interest of achieving effective invasive management. However, the first year's schedule should be specifically laid out. Depending on when construction is expected to commence (e.g., clearing, grading, etc.) the method of moving forward with treating invasive vegetation may need to be revised. If the exact start date of construction is unknown, the ISMP should be reframed that stresses the qualified invasive applicator/specialist can decide what treatment method and

timing should be utilized based on site conditions. SWCA also recommends the Applicant either check the label and edit the percentages of herbicide or revise the ISMP to specify that the label rates will be followed.

SWCA Comment 3: Section 3.1.1. The narrative includes multiple references to refuse that has been dumped on the site over the years. During the site walk on January 5, it was noted that as part of the proposed restoration work, the refuse would be removed as much as practicable.

SWCA recommends the Commission include a condition in the OOC, if issued, that requires all surficial refuse, including discarded clothing, metal, concrete rubble, lumber, plastic, and other similar garbage, to be removed from within the resource areas and their associated buffer zones within the limit of work. SWCA also recommends the Commission indicate that any refuse at the surface and partially buried be removed to a depth of up to 12 inches below ground (e.g., a shopping cart that has become partially buried in the soil).

BSC Response 3: BSC concurs with SWCA Comment 3 and agrees such a Condition be included as part of the OOC.

SWCA Response 3: No further response required.

SWCA Comment 4: Section 3.1.1. The narrative provides a brief discussion of the proposed restoration activities, specifically restoration plantings. However, successful habitat restorations consider a wide variety of considerations, beyond vegetation. More specifically, the wildlife habitat and vegetation evaluation provided in Attachment G of the NOI identifies numerous wildlife habitat features including large woody debris, snags, hard mast and berry producing forage, rocks and rock piles, and others.

SWCA recommends the restoration plan consider how to improve important wildlife habitat functions within the restoration area and include methods to provide important wildlife habitat features that may be lost due to proposed impacts elsewhere on site.

BSC Response 4: The Restoration Plan has been updated to include proposed placement of coarse woody debris and stones and a few stone piles using natural materials originating from within the limit of work on the project site. The Restoration Plan maximizes the use of native berry and mast producing vegetation to benefit wildlife habitat values of the restoration area. See Appendix for details of wildlife habitat features.

SWCA Response 4: SWCA concurs with these revisions. No further response required.

SWCA Comment 5: Section 3.1.1. The narrative and the wildlife habitat and vegetation evaluation identify numerous native and non-native trees and shrubs within the project limit of work, including the restoration area. However, out of the 17 proposed trees and shrubs to be planted, only two (red maple [*Acer rubrum*] and American hornbeam [*Carpinus carolineana*]) are included on the plant schedule.

SWCA recommends the restoration plan be revised to include species within the restoration area that occur on-site to better represent the diversity and community structure of adjacent habitats. There are numerous trees and shrubs documented in the NOI application materials that would be suitable for the restoration area including American elm (*Ulmus americana*), black cherry (*Prunus serotina*), yellow birch (*Betula allegheniensis*), sweet birch (*Betula lenta*), box elder (*Acer negundo*), silver maple (*Acer saccharinum*), white pine (*Pinus strobus*), sycamore (*Platanus occidentalis*), black willow (*Salix nigra*), and others that are also typically readily available as nursery stock.

BSC Response 5: BSC concurs with SWCA Comment 5 and has updated the proposed planting plan and shown approximate locations of wildlife habitats.

SWCA Response 5-1: The proposed planting plan still includes multiple species that are not representative of the of the diversity and community structure of the adjacent habitats (e.g., Atlantic white cypress [*Chamaecyparis thyoides*] and others). SWCA recommends the planting plan be revised to includes species that better represent the adjacent communities within the restoration area.

BSC Response 5-1: Please refer to Sheet L-100. No tree is proposed within the restoration area or compensatory flood storage area that is not specifically listed in SWCA Comment 5. BSC is providing a color-markup of the restoration planting sheet to clarify proposed species placements.

It should be noted that the planting plan is for the entire project site, including areas outside of the Commission's jurisdiction.

The proposed woodland and floodplain restoration seed mixes are as follows:

Botanical Name	Common Name
Asclepias syriaca	Common milkweed
Asclepias incarnata	Swamp butterfly weed
Symphyotrichum novae-angliae	New England aster
Chamaecrista fasciculata	Patridge pea
Elymus canadensis	Canada wild rye
Elymus virginicus	Virginia wild rye
Festuca rubra	Red fescue
Redbeckia laciniata	Green-headed coneflower
Schizachyrium scoparium	Little bluestem
Solidago juncea	Early goldenrod
Sorghastrum nutans	Indian grass
Symphyotrichum novi-belgii	New York aster
Baptisia tinctoria	Horseflyweed
Desmodium canadense	Show tick-trefoil
Euthamia graminfolia	Flat-top goldenrod
Pycnanthemum virginianum	Virginia mountain mint

***SWCA Response 5-2*: SWCA concurs with these revisions. No further response required.**

SITE PLANS

SWCA Comment 6: Sheet G-101, Planting Notes, Note 11. The site plans indicate that the plant species indicated on the plant list are recommendations only and that final selection of the species shall occur at the time of plant purchase, depending on availability and that the size and quantity shall not change without approval of the Applicant's landscape architect.

SWCA recommends this note be revised to indicate that the proposed planting species, sizes, and quantities may be subject to change based on availability. However, these changes should be approved by the Conservation Commission and should be approved prior to purchase.

<u>BSC Response 6</u>: BSC has made the recommended revision to the Sheet G-101 Planting Notes, Note 11. We recommend that the OCC allow administrative approval of such availability-based changes by the Conservation Commission or its authorized representative to prevent undue construction delays in making such substitutions if necessary.

<u>SWCA Response 6</u>: SWCA agrees with these revisions. No further response required.

<u>SWCA Comment 7</u>: Sheet G-101, Comprehensive Permit Notes, Comment I.5. This comment notes that dumping of woody vegetation, brush, and other debris in a resource area or its associated buffer zone is prohibited.

SWCA notes that an exception to this requirement might be considered for the restoration area as large woody debris, brush piles, and other similar wildlife habitat features provide quality habitat functions and are likely to increase the ecological value of the restored habitats.

<u>BSC Response 7</u>: Sheet G-101, Comprehensive Permit Notes, Comment 1.5 is a Condition of the Comprehensive Permit, and the wording is copied directly from that Condition. The intent of the Condition is to prohibit the dumping of materials removed during construction in the wetlands or buffer zone. In accordance with BSC Response 4 above, the Restoration Plan will be updated with detailed natural coarse woody debris and stone wildlife habitat features using materials originating from the site, but material removed from the site during construction will not be disposed of within resource areas or associated buffer zones in accordance with the Comprehensive Permit condition.

<u>SWCA Response 7</u>: SWCA agrees with this approach. No further response required.

<u>SWCA Comment 8</u>: Sheet G-101, Comprehensive Permit Notes, Comment I.25. The site plans note that the survival rate of planted species shall be 80% at the end of the third year and that a corrective action plan must be submitted if the survival rate is less than 80% at the end of the third year.

SWCA recommends the Commission consider requiring a corrective action plan to be developed by the Applicant if the 80% success rate is not met after any year of monitoring. Waiting until the third year of monitoring to develop and implement any corrective actions may unnecessarily prolong reaching the project's performance goals and may result in unnecessary disturbance to the area to rectify any adverse conditions since the restoration area will have had three years to establish.

<u>BSC Response 8</u>: Sheet G-101, Comprehensive Permit Notes, Comment I.25 is a condition of the Comprehensive Permit, and the wording is copied directly from that Condition. The Comprehensive Permit Condition was prepared upon the recommended conditions submitted to the Zoning Board by the Conservation Commission by letter dated October 14, 2021.

<u>SWCA Response 8</u>: No further response required.

<u>SWCA Comment 9</u>: Sheet L-100, Plant Schedule. The plant schedule includes a number of proposed cultivars within the 100-foot Buffer Zone (e.g., *Clethra alnifolia* 'ruby spice', *Hydrangea quercifolia* 'ruby slippers', and *Hydrangea arborescens* 'annabelle'). In accordance with condition I.24 of the Comprehensive Permit, all mitigation plantings and plantings within all resource areas shall be native, non-cultivar species. Additionally, other cultivars are proposed in other areas of the site along side non cultivars of native species (e.g., pin oak [*Quercus palustris*] and green pillar pin oak [*Q. palustris* 'pringreen']).

SWCA recommends the planting plan be revised to not include any cultivars.

BSC Response 9: BSC concurs with SWCA Comment 9 and has revised the planting plan to not include cultivars within the 100-foot buffer.

SWCA Response 9-1: The revised planting plan continues to propose a number of cultivars within the 100-foot Buffer Zone. Other cultivars are still proposed in other areas of the site.

SWCA recommends the planting plan be revised to not include any cultivars. SWCA also encourages the Applicant to utilize non-cultivars of native species throughout the site.

BSC Response 9-1: BSC has revised the proposed restoration planting plan to remove cultivars and has revised the proposed seed mixes for the restoration and compensatory flood storage areas to contain only native plants. The lawn seed mix has also been revised to contain only native species.

It should be noted that the planting plan is for the entire project site, including areas outside of the Commission's jurisdiction. There is one plant proposed that is a non-native landscaping plant, but it is proposed to be located along the walking path between the buildings, outside of the Commission's jurisdiction.

***SWCA Response 9-2*: SWCA concurs with these revisions. No further response required.**

SWCA Comment 10: Sheet L-100. A note on the plans indicates that all dead trees (i.e., snags) that do not provide wildlife habitat per the landscape architect and wildlife ecologist should be removed. Snags provide a wide variety of valuable habitat functions for wildlife including forage for insects, perches to hunt from, shelter if there are cavities or cracks, and other functions.

SWCA recommends this note be revised to indicate that only snags that pose a hazard (e.g., may fall and land on the buildings) may be removed and that removal of any snags must be approved by the Commission.

BSC Response 10: BSC concurs with SWCA Comment 10 and has revised Sheet L-100 according to SWCA's Comments 1 and 10.

SWCA Response 10-1: This note does not appear to indicate that removal of any snags must be approved by the Commission.

SWCA recommends revising this note as to indicate that Commission approval is required for snag removal.

BSC Response 10-1: The note on Sheets L-100 has been updated to state, "2. Remove all invasive species according to ISMP; cut and remove (do not stump) all dead trees that pose a safety hazard to people or property as determined by Landscape Architect (LA) & Wildlife Ecologist (WE) with administrative approval of Conservation Commission; restore areas with native tree, shrub, and grass plantings as directed by LA. Utilize cut plant materials to construct snags and wildlife habitats as directed by LA & WE.

***SWCA Response 10-2*: SWCA concurs with these revisions. No further response required.**

If you have any questions or comments, please do not hesitate to contact me at either (508) 232-6668 or chase.bernier@swca.com.

Sincerely,

P. Chase Bernier, CWB, PWS, CERP
Senior Natural Resources Team Lead

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APRIL 4, 2024

Arlington Conservation Commission
730 Mass Ave Annex
Arlington, MA 02476

RE: Notice of Intent
SWCA Notice of Intent Restoration Plan Peer Review
Thorndike Place Residential Community
Dorothy Road, Arlington, MA

Dear Members of the Arlington Conservation Commission:

On behalf of Arlington Land Realty, LLC (the Applicant), BSC Group, Inc. respectfully presents the following response to SWCA's peer review report dated March 27, 2024. The March 27 letter provides closure on nine (9) out of the ten original comments, finding that there is "no further response required" to Comments 1 and 3 – 10. SWCA Comment 2 pertains to the ISMP required under the Comprehensive Permit for this project which was submitted to the Commission and to SWCA for review on March 7, 2024.

From the March 27, 2024 SWCA Peer Review letter:

<u>SWCA Response 2-2:</u> In SWCA's experience, the most effective way to manage sites similar to the proposed project is to utilize an adaptive management approach. The mechanical, manual, and chemical options appear to be presented as if only one can be chosen for each species. For example, common reed (Phragmites australis) and Japanese knotweed, benefit from a combined approach (e.g., cutting first at the appropriate time and then treating with herbicide at the appropriate time. There also appears to be consistent issue throughout the ISMP of misrepresenting the proposed concentrations of herbicide and not mentioning that the chose herbicide label must be followed.

SWCA recommends the ISMP be adaptative and that sticking to a strict pre-set and unchangeable schedule from year to year is not in the best interest of achieving effective invasive management. However, the first year's schedule should be specifically laid out. Depending on when construction is expected to commence (e.g., clearing, grading, etc.) the method of moving forward with treating invasive vegetation may need to be revised. If the exact start date of construction is unknown, the ISMP should be reframed that stresses the qualified invasive applicator/specialist can decide what treatment method and timing should be utilized based on site conditions. SWCA also recommends the Applicant either check the label and edit the percentages of herbicide or revise the ISMP to specify that the label rates will be followed.

BSC Response 2-2-1:
BSC is recommending an Invasive Species Management Plan that relies on the best management practices (BMP) and professional judgment of a Senior Botanist with many years of successful invasive plant management experience. An adaptive strategy that combines both mechanical and chemical approaches to maximize control of invasives while minimizing unintended impacts is presented (ISMP, page 9). It is our intent to utilize mechanical control methods to the extent practical and minimize the duration and intensity of any chemical controls employed.

803 Summer Street, Third Floor / Boston, MA 02127

The management techniques chosen for this project are specific to this location based on the species found there, proposed future activities, and specific site conditions. The proposed invasive plant species management techniques are the BMPs for this location. For example, while common reed isn't presently within the treatment area, it was included as a potential future species due to its current presence in proximity to the treatment area. Including this species as a potential future invasive species was intended as a dimension of our adaptive management approach.

BSC disagrees with the reviewer's suggestion that pre-cutting Japanese knotweed and/or Phragmites is the best approach based on the potential timing of this project and the specific reproductive biology of this plant. It is well established that both Japanese knotweed and Phragmites spread via cuttings of the stems and rhizomes. Severing plants before chemical treatment will counterproductively spur additional growth and reduce the effectiveness of chemical treatments. In our Senior Botanist's experience, plants that have been chemically treated after being cut in the same season have a decreased probability of successful eradication and instead require increased subsequent chemical use for successful treatment – which we seek to avoid.

The Invasive Species Management Plan developed for Thorndike Place is intended to be an adaptive management plan. The timetables reflect an ability to initiate the ISMP at any time of year depending on a construction schedule that will be determined in the future. We prescribe specific treatment times depending on the specific requirements of the species on the site, i.e. knotweed must be treated after flowering during September and cut-stump treatments should only be performed between July 1 and December. The purpose of the proposed treatment timetable is to allow initiation of treatment at any point in the year, with proper treatment recommendations that fall sequentially into place after the ISMP initiation.

In all cases, the intent of our adaptive approach is to use both mechanical and chemical approaches as appropriate with the overall goal of maximizing successful eradication of invasives utilizing chemical controls in the lowest concentration consistent with best management practices.

It should go without saying that any herbicide applicator will be fully licensed and trained and required to follow the law (i.e.: the label) when applying herbicide. The submitted ISMP does not recommend any deviation from product labels for any specific herbicide and is consistent with standard best management practice for their use.

We look forward to an opportunity to discuss these revisions with the Commission and its Peer Review consultant at the upcoming hearing. Mr. Groves will again be available to discuss the ISMP and is also available to answer questions that may come up during the hearing.

If you have any questions regarding the enclosed information, please contact me at (617) 896-4594 or mburne@bscgroup.com. Thank you for your consideration in this matter.

Thank you,
BSC Group, Inc.

Matt Burne, PWS
Senior Ecologist

cc: Stephanie Kiefer

Arlington Conservation Commission

Date: April 4, 2024
Time: 7:00 PM

Pursuant to State Legislation suspending certain provisions of the Open Meeting Law, G. L. c. 30A, § 20 the meeting was held virtually using Zoom.

Attendance [0:06:45]

Commissioners:	Susan Chapnick (Chair) Chuck Tirone (Vice Chair) Mike Gildesgame David Kaplan	Brian McBride Nathaniel Stevens David White
Conservation Agent:	David Morgan	
Associate Commissioners:	Eileen Coleman	Sara Alfaro-Franco

Agenda

I. Administrative

1. Review Meeting Minutes.
   - N. Stevens made a motion to approve the minutes of 3/7/2024 as amended. M. Gildesgame seconded the motion. A roll call vote was taken:

     C. Tirone – yes S. Chapnick – yes M. Gildesgame – yes
     D. Kaplan – yes B. McBride – yes N. Stevens – yes
     D. White – yes

     Motion passed.
2. Correspondence Received.
   - The Chair noted that all correspondence received is available for the public to review by contacting D. Morgan.

II. Discussion [0:14:56]

1. Water Bodies Working Group.
   - D. White said that the Working Group requested $120,000 for FY2025. The Finance Committee approved $85,000.
   - N. Stevens made a motion to appoint E. Coleman to the Water Bodies Working Group. B. McBride seconded the motion. A roll call vote was taken:

     C. Tirone – yes S. Chapnick – yes M. Gildesgame – yes
     D. Kaplan – yes B. McBride – yes N. Stevens – yes
     D. White – yes

     Motion passed.

- The next meeting of the Working Group is next Thursday at 6:00 pm. D. White will send out an agenda.
- D. White noted that a new aerator for Hill's Pond will be purchased.

2. Tree Committee Update.
   - S. Alfaro-Franco said that the Tree Committee plans to plant 150 trees this spring season. They are a month and a half ahead of schedule because of the weather.

3. Artificial Turf Study Committee Update.
   - The next meeting, which will probably be the final meeting, will be Tuesday, April 9, 2024. The Study Committee is concluding its work. They have issued a draft report and posted it on their web page. That report will soon be finalized.

4. Arlington High School Permit Extension (DEP #091-0323). [0:19:58]
   - The team members introduced themselves:
     - Jeff Thielman, Arlington High School (AHS) Building Committee Chair
     - Kirsi Allison-Ampe, School Committee Chair, AHS Building Committee Member
     - Jim Feeney, Town Manager
     - Liz Homan, School Superintendent
     - John Amato, JJA Sports, Sports Field Designer
     - Steve Garvin, Civil Engineer, Samiotes Consultants
     - Laurie Coles, HMFH Architects
     - Arthur Duffy, HMFH Architects
     - Jim Burrows, Skanska, OPM
     - Matthew Janger, AHS Principal
   - J. Thielman said that the AHS Building Committee is requesting an extension of the Order of Conditions granted by the Commission in 2020 for the synthetic turf fields for the new Arlington High School. During early community discussions and the 2019 voter approval of the project, synthetic turf fields have always been proposed. To remain on schedule and on budget, the infill for the synthetic fields must be ordered by June 30, 2024, less than 90 days from this meeting.
   - In the summer of 2020, the Conservation Commission reviewed plans for the turf fields and concluded that the fields as designed did not have a significant or cumulative effect on the wetland values protected by the bylaw, and the Commission granted an Order of Conditions. In 2021, the Town signed seven contracts for work to be performed on the fields; by 2023, some of the systems supporting the fields were built. In July 2023, the AHS Building Committee applied for an extension of the 2020 Order of Conditions. During the meeting, the Commission was told about new information pertaining to 6PPD and 6PPD-quinone. When this information was given to the Building Committee in August 2023, the Committee agreed to evaluate the costs, risks, and benefits of crumb rubber and alternative infills and study the applicability of the research to the specific conditions at AHS. The Commission granted a one-year extension to the 2020 Order of Conditions.

- L. Homan noted that any changes made to the design at this late stage in the project are likely to significantly impact the budget and schedule. The Building Committee initially chose turf fields because they provide a better performance environment and have manageable maintenance, and the environmental impact can be mitigated through the design. Alternatives to crumb rubber create additional costs and have significant drawbacks, including negative impacts to safety and athletic performance. There is also less data on the alternatives. Crumb rubber infill is the best option currently; it has proven data, and many installations have successfully mitigated the environmental impact. It has superior athletic performance, longevity, and safety conditions, as well as lower cost.
- K. Allison-Ampe said that in August 2023, the Commission raised concerns about toxicity of 6PPD-quinone for fish in Mill Brook. The Building Committee and its consultants have reviewed multiple studies and concluded that the conditions needed to create 6PPD-quinone are not present in the AHS field design. 6PPD is used in rubber tires. The combination of smog and volatile organic compounds plus UV light from sunlight acts on 6PPD to form 6PPD-quinone, which occurs in tiny particles called tire abrade which can be washed off roadways and into ecosystems where they are toxic to fish. Biofilters composed of leaf mold sand and crushed stone have been found to protect fish. Tire abrade particles range from 1 to 1,000 microns; rubber infill particles range from 1,000 to 2360 microns. The compositions of tire abrade and rubber infill are also quite different; rubber infill includes no metals and meets Standard Consumer Safety Specification for Toy Safety. The AHS field drainage plan includes extensive filtration, including the possible inclusion of additional baskets, so that only clean water will drain into Mill Brook.
- J. Feeney said that the AHS Building project is funded by 2019 debt exclusion vote, combining funding from Arlington taxpayers and the state. At the beginning of the project, the Town entered into a project funding agreement with the Massachusetts School Building Authority (MSBA), and the Town is required to stay within that budget. If the Town wishes to add more funds, the MSBA has sole discretion to determine if additional funding is eligible. If the funding is ineligible, it would proportionally decrease the Town's maximum total facilities grant portion, so the Town could lose project reimbursement funds. To date, the total committed costs of the turf fields is just over $1,200,000. Any material changes in the plans for the fields will cause the locked-in subcontract values to increase. If a contract were to be cancelled, a subcontractor to bring a claim against the Town for lost revenue. In August 2023, the Commission asked if the Building Committee could use contingency funds for an alternative infill. The Committee did consider that, but they do not believe that there are enough contingency funds. Contingency funds have been used for several unforeseen costs already, and the project is entering a phase of construction with significantly higher risks. Even if sufficient contingency funds were available, the Committee, the school district's leadership, and the project design team did not believe that it was in the best interest of the students and the community to purchase an alternative infill.
- J. Thielman said that the Building Committee has reviewed all the available information and recently voted unanimously to reaffirm their decision to use crumb rubber infill. They request an extension of the Order of Conditions.
- C. Tirone clarified that this is not a hearing and will not result in a vote. The hearing will be held at the Commission's next meeting.

- N. Stevens said that he would like to know more about how the proposed basket filtration works and how it would be maintained, as well as whether contingency funds could be used to pay for it. J. Thielman said that it would be an additional cost of $15,000 to $18,000. A. Duffy said that there are 18 trench drain basins, which have sump pumps. The manufacturer also offers the option of screen baskets that can capture larger particulars of crumb rubber, leaves, pine needles, etc. The maintenance plan would be to open up the hatches and empty the baskets a few times a year. N. Stevens said that he would like to see a cut screen of the basket. He also said that an extension would not allow for any changes, so including the baskets might require an amendment to the Order of Conditions.
- B. McBride asked how confident the Building Committee is that 6PPD-quinone will not develop under the conditions of the turf fields, and if they would be willing to accept a monitoring condition to determine whether it does develop. K. Allison-Ampe said that an approved test for 6PPD-quinone in water does not currently exist. When such a test becomes available, they would be willing to consider it.
- M. Gildesgame said that in his experience of the turf field at Arlington Catholic, the crumb rubber is everywhere, both above and below the grass, so he is not confident that it would be shaded by the grass and therefore not exposed to the environment. Such exposure would make it more likely that 6PPD-quinone would develop. K. Allison-Ampe said that she does not know the exact conditions of the Arlington Catholic field, but that their plans include a large enough layer of fiber that the crumb rubber would be protected. A. Duffy said that they cannot guarantee that the crumb rubber will not be exposed to any sunlight, but that it will be significantly more shaded than tire abrade on a highway, as the fiber layer will form a constant shadow. Different types of field carpet exist; the product that the Building Committee intends to use has a tall fiber height, as well as shorter fibers that grip the crumb rubber, reducing the likelihood that the rubber will migrate.
- N. Stevens asked about the plans for clearing the field of snow. M. Janger said that in his eleven years as principal, they have only once had to clear the fields of snow, and it was done by the turf company. J. Thielman said that they would follow the instructions of the turf company to do so safely.
- C. Tirone said that his understanding is that the field would be filled up as much as possible with crumb rubber, which would then be shifted around by weather conditions. He asked how often maintenance and grooming of the field would happen, and whether the Building Committee owns the equipment necessary to do the maintenance. Without regular maintenance, crumb rubber will end up outside of the field area. J. Thielman said that a maintenance plan is attached to the memo shared with the Commission. Some of the maintenance will be done by school staff, and some will be done by a contractor.
- C. Tirone asked if the treatment train is an isolated system or if it accepts infiltration from other sources. K. Allison-Ampe said that it is an isolated system and will not accept water from any other source.
- N. Stevens said that the Commission needs to check the existing Order of Conditions to see if the maintenance plan is included in it. D. Morgan said that the maintenance plan is not in the Order of Conditions; J. Thielman said that they would include that as an amendment.

- Discussion of the procedural issues involved in extending and/or amending an Order of Conditions followed.
- S. Chapnick noted that, although issues such as playing time and player safety are not in the purview of the Commission, the Artificial Turf Study Committee has clearly stated in its draft report that alternatives to crumb rubber infill should be used because of its negative impacts to human health, safety, and the environment.
- S. Chapnick stated that the Commission's review of the permit extension request is concerned with environmental issues, particularly as they affect Mill Brook. In 2020, the Commission placed specific conditions on testing the field materials, including the crumb rubber. Those tests must meet the regulatory requirements put forth by the Commission. The Commission did not require testing for 6PPD-quinone, because it was not discovered as a potential aquatic toxin until 2021, so it is important that the Commission consider that issue now. She noted that tire crumb rubber contains some amount of 6PPD-quinone. K. Allison-Ampe agreed, but said that it would remain within the field and, because of the filtration system in place, not run off into Mill Brook. S. Chapnick said that bio-retention basins have been shown to reduce the amount of 6PPD-quinone from getting into the environment, but the field filtration system does not include bio-retention basins. K. Allison-Ampe said that the filtration system contains some components of bio-retention basins.
- S. Chapnick noted that when a Commission considers a request for a permit extension, the Commission may deny the request in cases "where new information, not available at the time the permit was issued, has become available and indicates that the permit is not adequate to protect the resource area values protected by the Bylaw." Since the original permit, it has been established that tire crumb rubber can contain 6PPD-quinone, and that 6PPD-quinone is toxic to fish at extremely low concentrations. She noted that the filtration system may prevent crumb rubber from ending up in Mill Brook, but that does not prevent the chemicals coming off it from ending up in the brook. S. Chapnick concludes that used-tire-derived material may already contain 6PPD-quinone and may have the opportunity for 6PPD to convert to 6PPD-quinone. An EPA draft method for evaluating 6PPD-quinone just came out in January 2024, and will likely be finalized this year. Many labs are already using this test.
- K. Allison-Ampe noted that most of the crumb rubber material lost from turf fields is not lost through surface water. A recent literature review suggests that only 125 kg of the material is lost through surface water and ends up in drains. Another review suggests that Arlington residents generate between 135 and 250 metric tons of tireware particles per year, a vastly larger amount than results from crumb rubber materials in surface water. She also noted that Peirce field, AHS's current artificial turf field, is not packed to overflowing with crumb rubber, and future fields would not be over-filled either.
- N. Stevens said that he would like the Building Committee to apply to amend the Order of Conditions to include the maintenance plan and the use of the filtration baskets. Those amendments and the extension request could both be considered at the same hearing. C. Tirone noted that the application to amend the Order of Conditions could not be considered at the Commission's next meeting due to the application deadline. The hearing would have to be scheduled for May 2, at which the Order of Conditions would first be amended and then extended.

- S. Chapnick noted that there is precedent from DEP for a superseding Order of Conditions to allow the field to proceed with conditions, including monitoring of the stormwater coming out of the field before it goes into the resource area. She would like the Building Committee to consider a monitoring well that would monitor for 6PPD-quinone. B. McBride agreed.
- C. Tirone noted that the Commission cannot require the Building Committee to apply for an amendment to the Order of Conditions.
- C. Tirone summarized the items that the Commission have asked the Building Committee to provide before the hearing: a cut sheet for the filter basket, the study on sand filters, the study on tire road particulates. The Commission would also like the Building Committee to apply for an amendment to the Order of Conditions, including maintenance specs and a monitoring well and program.
- S. Garvin noted that they have already applied for a permit extension, the hearing for which is scheduled for April 18. If they choose to file an application for an amendment to the Order of Conditions, that hearing would be scheduled on May 2. They may choose to postpone the hearing for the permit extension until May 2, but the hearing is currently scheduled for April 18.
- M. Gildesgame asked what the testing standard would be if a monitoring well is installed. S. Chapnick said that she would propose the number that caused fish kills in a peer-reviewed paper. She proposed using the testing frequency that the DEP approved for a test well in Wilmington, which N. Stevens can provide information about.

5. Eagle Scout Proposal for Arlington Great Meadows. [1:49:00]
   - Ben Gregory, from Troop 313 based in Arlington, has proposed an Eagle Scout project at Arlington Great Meadows. He has been working with D. White on planning an Eagle Scout Project.
   - The proposed project is to build a sign that reads “Arlington’s Great Meadows” at the Emerson Gardens entrance and a new kiosk at the Sheila Road entrance. The new kiosk will be modeled on the current kiosk at the Waldorf School entrance. It will be constructed of pressure-treated lumber, with 6x6 posts. If permitted, he would like to use concrete to secure the posts of both the kiosk and the sign.
   - The estimated cost is approximately $550, which will be raised by the Troop. He hopes to have the project completed by mid- to late-April. His grandfather, who has construction experience, will help with the carpentry.
   - D. White said that using concrete should be fine because it is not near a resource area.
   - The Commission members appreciated the proposal and thanked B. Gregory for taking on the project.
   - D. White made a motion to approve the project. N. Stevens seconded the motion. A roll call vote was taken:

C. Tirone – yes	S. Chapnick – yes	M. Gildesgame – yes
D. Kaplan – yes	B. McBride – yes	N. Stevens – yes
D. White – yes		

Motion passed.

6. 47 Spy Pond Lane Certificate of Compliance. [2:01:12]
    - R. Clapp said that the Commission issued an Order of Conditions in 2020 for construction of a single-family house at 47 Spy Pond Lane. A previous site visit confirmed compliance with the Order of Conditions, except that the owner had constructed a chain link fence that blocked the passage of wildlife next to the resource area. The property owner has since cut three gaps in the fence, each of which are about four to six inches from the ground and about three feet long, to allow for the movement of wildlife.
    - Overall, the project is in compliance with the Order of Conditions, and R. Clapp recommends that the Commission issue a Certificate of Compliance.
    - N. Stevens made a motion to issue a Certificate of Compliance for 47 Spy Pond Lane. D. Kaplan seconded the motion. A roll call vote was taken:

C. Tirone – yes	S. Chapnick – yes	M. Gildesgame – yes
D. Kaplan – yes	B. McBride – yes	N. Stevens – yes
D. White – yes		

Motion passed.

7. 19 Sheraton Park Certificate of Compliance. [2:05:54]
    - D. Morgan said that the Commission issued an Order of Conditions in 2011. The only item not completed by the time the permit was expired was the installation of dry wells. The owners asked for a Certificate of Compliance in 2022, but the Commission noted that the work was not complete. The Commission issued an RDA for the completion of the work required by the original Order. R. Clapp conducted a site visit and found it to be in compliance.
    - D. Kaplan made a motion to issue a Certificate of Compliance for 19 Sheraton Park, and N. Stevens seconded the motion. A roll call vote was taken:

C. Tirone – yes	S. Chapnick – yes	M. Gildesgame – yes
D. Kaplan – yes	B. McBride – yes	N. Stevens – yes
D. White – yes		

Motion passed.

III. Hearings

1. **Request for Determination of Applicability: 36 Peabody Road (Continued from 3/21/2024). [2:09:34]**
    - This public hearing will consider a Request for Determination of Applicability for an addition to the existing structure at 36 Peabody Road in Arlington along with landscaping and hardscaping activities within the 100-foot Buffer Zone and Adjacent Upland Resource Area to Spy Pond.
    - S. Chapnick reported that the project is to repair walls that are failing due to improper installation and the steepness of the grade. The project also includes an addition to the house with a minor intrusion into the 100-foot buffer zone and the Adjacent Upland Resource Area (AURA) to Spy Pond.

- S. Chapnick, N. Stevens, M. Gildesgame, B. McBride, and C. Tirone conducted a site visit, with the owners present. They saw an example of the type of wall the owners plan to install. They also saw the terracing of the steep hill, which includes extensive native plantings. The Commission previously expressed concern with the placement of the walls; at the site visit, the Commissioners agreed that the proposed placement of the walls is necessary due to the erosion. The owners also plan to move one tree and remove two trees, one of which is hazardous, as well as plant several new trees.
- S. Chapnick expressed uncertainty about whether this work should be an RDA or an NOI, given that it is stonework. All the work will be done by hand, and it will include erosion controls.
- Eliza Hatch, the homeowner, said that they plan to move the wall and repair the staircase, all by hand. They plan to place erosion control at the bottom of the hill, where the slope gets less steep.
- C. Tirone said that the owners have taken great care of the property and the resource area. Given all the care that they've taken, he has no problem with approving this work as an RDA.
- M. Gildesgame agreed that the owners have done a good job stabilizing a very steep slope.
- S. Chapnick opened the hearing to public comment. Seeing no one who wished to speak, she closed public comment.
- N. Stevens made a motion to close the hearing. M. Gildesgame seconded the motion. A roll call vote was taken:

C. Tirone – yes	S. Chapnick – yes	M. Gildesgame – yes
D. Kaplan – yes	B. McBride – yes	N. Stevens – yes
D. White – yes		

  Motion passed.
- C. Tirone made a motion to issue a positive negative determination to the RDA, with the condition of a 20-foot section of erosion control at the bottom of the hill, to be reviewed by the Conservation Agent prior to work. N. Stevens seconded the motion. A roll call vote was taken:

C. Tirone – yes	S. Chapnick – yes	M. Gildesgame – yes
D. Kaplan – yes	B. McBride – yes	N. Stevens – yes
D. White – yes		

  Motion passed.

2. DEP #091-0278: Amendment to Order of Conditions: 88 Coolidge Road (Continued from 3/21/2024). [2:22:15]

- This public hearing will consider the peer review report for an amendment to an Order of Conditions for construction of a new house at 88 Coolidge Road in the Buffer Zone to a Bordering Vegetated Wetland. The applicant requested that the hearing be continued to April 18, 2024.

- N. Stevens made a motion to continue the hearing to April 18, 2024. B. McBride seconded the motion. A roll call vote was taken:

  C. Tirone – yes | S. Chapnick – yes | M. Gildesgame – yes
  D. Kaplan – yes | B. McBride – yes | N. Stevens – yes
  D. White – yes

  Motion passed.

3. DEP #091-0356: Notice of Intent: Thorndike Place (Continuation from 3/21/2024). [2:23:09]

- The Conservation Commission will hold a public hearing under the Wetlands Protection Act to consider a Notice of Intent for the construction of Thorndike Place, a multifamily development on Dorothy Road in Arlington. Continued Planting Plan/ Habitat discussion including Invasive Species Management Plan, and, if time allows, continued stormwater discussion.
- D. White recused himself from the hearing and left the meeting.
- The applicant was represented by Matt Burne, BSC Group Senior Ecologist, Tom Groves, BSC Group Senior Botanist, Dominic Rinaldi, BSC Group Civil Engineer, Stephanie Kiefer, Project Attorney, John Hessian, Consulting Engineer, and Scott Oran and Mark Dufton, Dinosaur Capital Partners.
- M. Burne noted that peer reviewer SWCA issued a letter in February with 10 comments relating to the planting plan and invasive species management. SWCA issued a follow-up letter on March 27, which said that all but one of their comments had been adequately addressed. The only remaining comment was 2-1, which recommended that the Invasive Species Management Plan (ISMP) be submitted for review, which was done. The SWCA response 2-2 expressed their experience in effective ways to manage sites similar to the proposed project, using an adaptive management approach. It also said that there are consistent issues throughout the ISMP of misrepresenting the proposed concentrations of herbicide, and not mentioning the choice of herbicide label must be followed. M. Burne said that the whole purpose of the ISMP is to be an adaptive management plan, using a combined approach that ultimately reduces the need for chemical controls.
- T. Groves said that the ISMP includes two main approaches – the first is a primarily chemical approach but includes a mulching option; the second is a chemical, mechanical, and chemical approach, dependent on species. Japanese knot weed does not respond well to a mechanical approach first, so it is best to use a chemical approach first, followed by mechanical cutting, and then another chemical application. The timetable included in the ISMP allows for some variability of start times, since the construction timetable is unknown. The construction should not be an impediment to treatment.
- S. Chapnick said that the Commission is concerned about the use of glyophosate. She quoted an NIH study saying that exposure to glyphosate-based herbicides cause neurotoxic effects in humans, rodents, fish, and invertebrates. T. Groves replied that much of the information relating to glyphosate is based on industrial farming, which generally applies glyphosate throughout the growing season to unhealthy soil, which results in a lot of runoff. Many agencies use glysophate,

because it has been used for a long time and has been well-studied, and it is the safest herbicide to use in these situations. The herbicide proposal in the ISMP is a wetland herbicide with a non-ionic surfactant. In an ecosystem application, it is applied once a season in small amounts, directly to the surface area, so it stays within the root system, with little runoff. At this location, the wetland is not close to where the treatment would take place. The invasive plants being treated are also destructive to the environment, more so than glysophate would be. He estimated that less than a quart of herbicide would be used to get the invasive species under control, which is minimal compared to the amount of effort and money it would take to use a mechanical method, which would also ultimately not solve the problem.

- S. Chapnick asked if there are safer alternatives to glyphosate. She noted that many countries have banned glyphosate. T. Groves replied that glyphosate is the safest herbicide for these situations, and banning glyphosate will lead to the use of more dangerous chemicals.
- S. Chapnick also asked if they can avoid using air spray. T. Groves replied that he has proposed a low-volume, low-pressure backpack sprayer. In his experience, using stem-injection or cut-stump techniques on Japanese knotweed results in putting the herbicide into water within the plant, diluting it. The concentration required for that type of treatment is higher than what is allowable per acre. Using a low-pressure spray treatment is very targeted and more effective than stem injection. Even if the spray gets on nearby native plants, it will not kill those plants as long as the whole plant is not treated.
- S. Chapnick also asked if using the herbicide will harm newly planted plants that are part of the landscaping plan. T. Groves replied that for glyphosate to kill a plant, it must be applied to the leaf surface or an open wound on the plant; it does not work in the soil, so will not harm other nearby plantings. The return interval is four hours, so it would be safe to re-enter an area four hours after treatment.
- S. Chapnick asked if the applicant could do a treatment plan with no spraying at all. T. Groves said that using a spray is the only way to effectively treat Japanese knotweed. The ISMP does include mechanical treatment of other species.
- M. Gildesgame asked how long it would take to control the Japanese knotweed. T. Groves replied that with the methods laid out in the ISMP, he could achieve 95% control within a year. The ISMP does include a follow-up, because seedlings will reappear, but the follow-up may not be needed in the first year after a treatment. Monitoring the site is important.
- D. Kaplan asked if wiping herbicide on the plant would result in sufficient coverage to be effective, rather than spraying. He also asked if there should be no-spray buffer zones near the wetlands. T. Groves replied that the backpack sprayers result in very little drift; they can be closely targeted, and the droplets are large enough not to drift. He also said that wiping requires a heavier substance, so that it doesn’t drip, and it doesn’t work well on knotweed. Wiping works better with fragmites. Japanese knotweed is primarily a monoculture, so it’s unlikely that a spray would hit native plants.
- D. Kaplan expressed concern that using mulch to smother invasives would prevent other groundcover to grow. T. Groves said that the site includes a large amount of garlic mustard, which is very tenacious and changes the soil chemistry. The mulch

would both kill the garlic mustard and help to rebuild the soil, which would enable other groundcover to grow in the future. He proposed three inches of mulch in the areas with garlic mustard.

- C. Tirone asked if the ISMP includes recommendations of nozzle and droplet size. T. Groves said that backpack sprayers generally come with either wands or guns, which come with nozzle sizes already within particular parameters. Low-pressure backpack sprayers won't aerosolize the droplets. He also noted that there are laws about the conditions under which treatments can take place. The label outlines the requirements regarding conditions and application gear. S. Chapnick noted that the Commission has in the past placed conditions on spraying that are stricter than the requirements on the label.
- M. Burne noted that SWCA's response 2.2 says that the ISMP should be adaptive and not stick to an unchangeable schedule from year to year. He said that the ISMP is intended to be adaptive to when the project starts and what windows of opportunity will be available.
- SWCA also recommended that the ISMP be revised to indicate that label rates of herbicides will be followed. M. Burne noted that the label is the law, so a licensed applicator should follow it, and they did not think it necessary to include that in the ISMP. They can revise the ISMP to say that the label must be followed if necessary, but for professionals, that goes without saying.
- Chase Bernier from SWCA said that he agreed with a lot of what T. Groves and M. Burne said. This is a challenging site, with a lot of different species, and the ISMP approaches it well. Japanese knotweed is extremely difficult to control, and it requires herbicide to treat effectively.
- C. Tirone opened the floor to public comment:
  - Lisa Fredman, 63 Mott St – She found the discussion on glyphosate concerning. She is trained as an epidemiologist. Although epidemiology deals with large populations, most studies start with case studies and examples. Her friend's brother recently died of ALS. He was the first of a growing number of cases of relatively young people in Vermont dying of ALS who are presumed to have had exposure to algae growth and ponds were herbicides were used. The Mugar property is right next to the wetland. Every time she walks by Thorndike Field, there has been standing water. Use of herbicides on the property will move toward that standing water, which will effect the people who use and live near Thorndike Field. She thinks that epidemiologists should be included in this discussion.
    - S. Chapnick responded to say that while the Commission cares about human health, it's not in their purview; they need to focus on the environmental impact. She encouraged L. Fredman to share her comments with the Arlington Board of Health, because if there are issues involved that affect human health, they need to be involved.
    - T. Groves recommended that L. Fredman look at lawn-care companies. Herbicide and pesticide applicators are required to report to the state what herbicides and pesticides they use and in what quantities. That information is available to the public, so it's possible to see what has been used in any given neighborhood. Lawn care companies generally use far more of such

chemicals than the ecological industry, which uses them in very low quantities. Once a habitat is restored, you don't need to continue to use herbicides, but they are used year after year in lawn care, particularly in the golf industry.

- C. Tirone said that between the last two meetings, the Commission has received 11 emails from abutters and residents throughout Arlington, all of which are available on the Thorndike page of the Commission's website. Most of those had to do with groundwater testing.
- The Commission has completed the portion of the hearing dealing with the habitat and invasive management portion of the application, and going forward, will focus on the stormwater portion.
- D. Rinaldi said that the applicant has authorized the BSC Group to do more stormwater test pits and install a second well in the area of the large infiltration system, and to monitor those through April and into May. The installation will likely take place the week of April 15, so they would like to continue the hearing until May 2. C. Tirone said that the Commission would like someone representing the Town to witness the installation of the wells. D. Rinaldi said that he would communicate the installation date to D. Morgan.
- C. Tirone re-opened the floor to public comment:
    - Scott Horsley, water engineer representing the Arlington Land Trust – He would recommend that the applicant use continuous recording pressure transducers. Water levels vary frequently, and it's easy to miss high points without continuous recording.
        - D. Rinaldi replied that the current well on the site does not have continuous monitoring, and the new one is not intended to either. S. Chapnick asked BSC to consider using continuous monitoring, which could be easier to use than wells that require some to go to the site to collect the data. D. Rinaldi said that continuous monitoring is not required under the Wetlands Protection Act. C. Tirone asked how many times BSC expects to go to the site to collect data. D. Rinaldi said that they hope to do it at least weekly through the end of April and into May. C. Tirone asked if a representative of the Town could be present each time the well is checked, and D. Rinaldi replied that he would have to talk to the applicant about that.
- With the approval of the applicant, N. Stevens made a motion to continue the hearing to May 2, 2024. M. Gildesgame seconded the motion. A roll call vote was taken:

C. Tirone – yes	S. Chapnick – yes	M. Gildesgame – yes
D. Kaplan – yes	B. McBride – yes	N. Stevens – yes

Motion passed.

D. Kaplan made a motion to adjourn. The meeting adjourned at 10:20 PM.